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نموذج رقم (١٨)
اقرار والتزام بالمعايير الأخلاقية والأمانة العلمية
وقوانين الجامعة الأردنية وأنظمتها وتعليماتها
لطلبة الماجستير

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عنوان الرسالة: SUSCEPTIBILITY of THREE POPULATIONS OF GREEN PEACH APHID MYZUS PERSICAE SULZER (HEMIPTERA: APHIDIDAE) TO FOUR INSECTICIDES AND ITS BIOLOGY FOR THREE GENERATIONS

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توقيع الطالب: .... التاريخ: ٢٦ / ٤ / ٢٠١١

SUSCEPTIBILITY OF THREE POPULATIONS OF GREEN PEACH APHID *MYZUS PERSICAE* SULZER (HEMIPTERA : APHIDIDAE) TO FOUR INSECTICIDES AND ITS BIOLOGY FOR THREE GENERATIONS

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Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Plant Protection

Faculty of Graduate Studies
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April 2011

COMMITTEE DECISION

This Thesis " Susceptibilty of Three Populations of Green Peach Aphid *Myzus persicae* Sulzer (Hemiptera : Aphididae) to Four Insecticides and Its Biology For Three Generations " was successfully defended and approved on 14-4-2011

This thesis was successfully defended and approved on 14-4-2011

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DEDICATION

This piece of work is dedicated to my parents, my wife and to my childern (Abudullah , Saif) .Their patience, understanding and continued love are valued- may God illuminate the paths on which they tread.

ACKNOWLEDGEMENT

In the beginning I thank my God for providing me with enough patience and endurance to carry out this research.

This work presented in this thesis was carried out under the guidance and supervision of Prof. Tawfiq Al-Antary who gave me all the support , guidance, encouragement to carry out this research , so I would like to thank him for every thing .

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SUSCEPTIBILITY OF THREE POPULATIONS OF GREEN PEACH APHID *MYZUS PERSICAE* SULZER(HEMIPTERA:APHIDIDAE) TO FOUR INSECTICIDES AND ITS BIOLOGY FOR THREE GENERATIONS

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ABSTRACT

Laboratory bioassays were conducted to evaluate the toxicities of four pesticides, traditional and recent that were used for controlling green peach aphid .This aphid was collected from Madaba , Deir-Alla as two field populations. The sensitive population was collected from far away valleys in Aum-AlAmmed of Jordan on the wild mustard then it was reared in greenhouse in Jordan University for ten generations . pepper plants were used as hosts for the three populations. The LC_{50} , LC_{90} for Calypso, Karate Evisect and Dimethoate were: (34.97, 100.14) , (18.34 , 40.17) , (2.13 , 7.45) and (17.95 , 37.97) in ppm, respectively. The ratio between LC_{50} for field populations divided by LC_{50} for sensitive population (RF), for Calypso, Karate, Evisect and Dimethoate were : (1.32 , 3.88 , 5.07 and 35.9), respectively . According to these values Calypso was the most effective pesticide followed by Karate, then Evisect . Dimethoate was significantly less toxic compared with other tested pesticides. It might be probably that the green peach aphid has been gained resistance to Dimethoate. It is recommended not to use Dimethoate any more for controlling green peach aphid. The toxicity for Calypso against the aphid had persisted for three generations compared with the other tested pesticides as indicated when the LC_{50} for each pesticide was used in the experiment . In longevity and fecundity experiment, Calypso has significantly increased the fecundity and longevity of green peach aphid, while Karate has significantly reduced the longevity and the fecundity of green peach aphid. Evisect had a little increase on the fecundity but their was no affect on the longevity of green peach aphid. Dimethoate has increased the fecundity and the longevity of green peach aphid more than Evisect but less than Calypso .

1. Introduction

The green peach aphid *Muzus persicae* Sulzer (Homoptera : Aphididae) is globally an important pest . It causes destructive damage to vegetables and fruit trees in the world (Lecrone and Smilowitz, 1980 , Parker *et al*, 1983). Originally described by swiss entomologist Johann Heinrich Sulzer in 1776 , its specific name is derived from the Latin genitive persicae " of the peach ". In Jordan , Mustafa (1986a) recorded the green peach aphid on many host plants . Vegetables in Jordan are considered hosts for the green peach aphid (Al-Mommany and Al-Antary,2008).Hamdan (1986) investigated factors affecting the green peach aphid populations on economic vegetables in Jordan. (Nazer *et al*, 1985) studied the response of the melon aphid to certain insecticides in Jordan Vally. This aphid is a polyphagous species. It is an economic pest, because of its ability to transmit viruses to plants. It reproduces sexually year around on large secondary hosts including potatoes, tomatoes , brassicas , beets , cereals , pasture clovers, peas, peppers and Roses (Cameron and Fletcher,2004). Green peach aphid , is capable of becoming resistant to a wide range of insecticides groups . Pest management strategies aimed at preventing or minimizing resistance will help maintain control and conserve the effectiveness of existing products (Cameron, 1996).

Green peach aphid is distributed world wide and several resistant strains have been identified using molecular techniques. A form with a chromosomal translocation is wide spread in glass houses and has been shown to have very high levels of resistance (Blackman and Devonshire , 1978). Green peach aphid has a well documented history of insecticides resistance to most classes of insecticides (Foster *et. al*, 2007). There is an important resistance mechanism in *Myzus persicae* (Insect Resistance-Action Group,2004), that depends on increasing the amounts of enzymes called

esterases which are able to break down insecticides before they reach their target sites . Aphids can be classified as susceptible moderately resistant ,highly resistant , or extremely resistant (Insect Resistant- Action Group, 2004). In green peach aphid ,other resistant mechanism can be occurred to other groups of pesticides. Abedl - Wali (2000) studied the toxicity of certain pesticides on the green peach aphid and its parasitoid *Aphidius matricariae* (Hymenoptra : Aphidiidae) .

A preliminary field survey has shown resistance of green peach aphid in some regions in Jordan. The aims of this study is as follows :

1. Determine the effect of four insecticides on green peach aphid.
2. Study green peach aphid populations resistance for four insecticides.
3. Evaluate insecticides toxicity on longevity and fecundity of survived aphids for three generations

2. Literature Review

2.1 *Myzus persicae* As a Species

2.1. a. Morphology

There are two morphs for this aphid : apterous morph and alate morph .Wingless adults are pale or bright green and black. Wingless adult is rather slender in light, green, or yellowish in color (Blackman and Eastop,1994).

It characterized by the presence of highly developed antennary tubercles forming a deep furrow in the frontal region of the head (converging antennal tubercless) (Plate 1),and slightly swollen cornicle (Plate 2), The cauda bears three pairs of setae on its posterior end (Bodenheimer and Swirski,1957, Blackman and Eastop, 1994). However , the immature forms are yellow, pinkish, or pale green.



Plate(1): The wingless green peach aphid with converging antennal tubercles.

At Entomology Lab. Faculty of Agriculture in University of Jordan

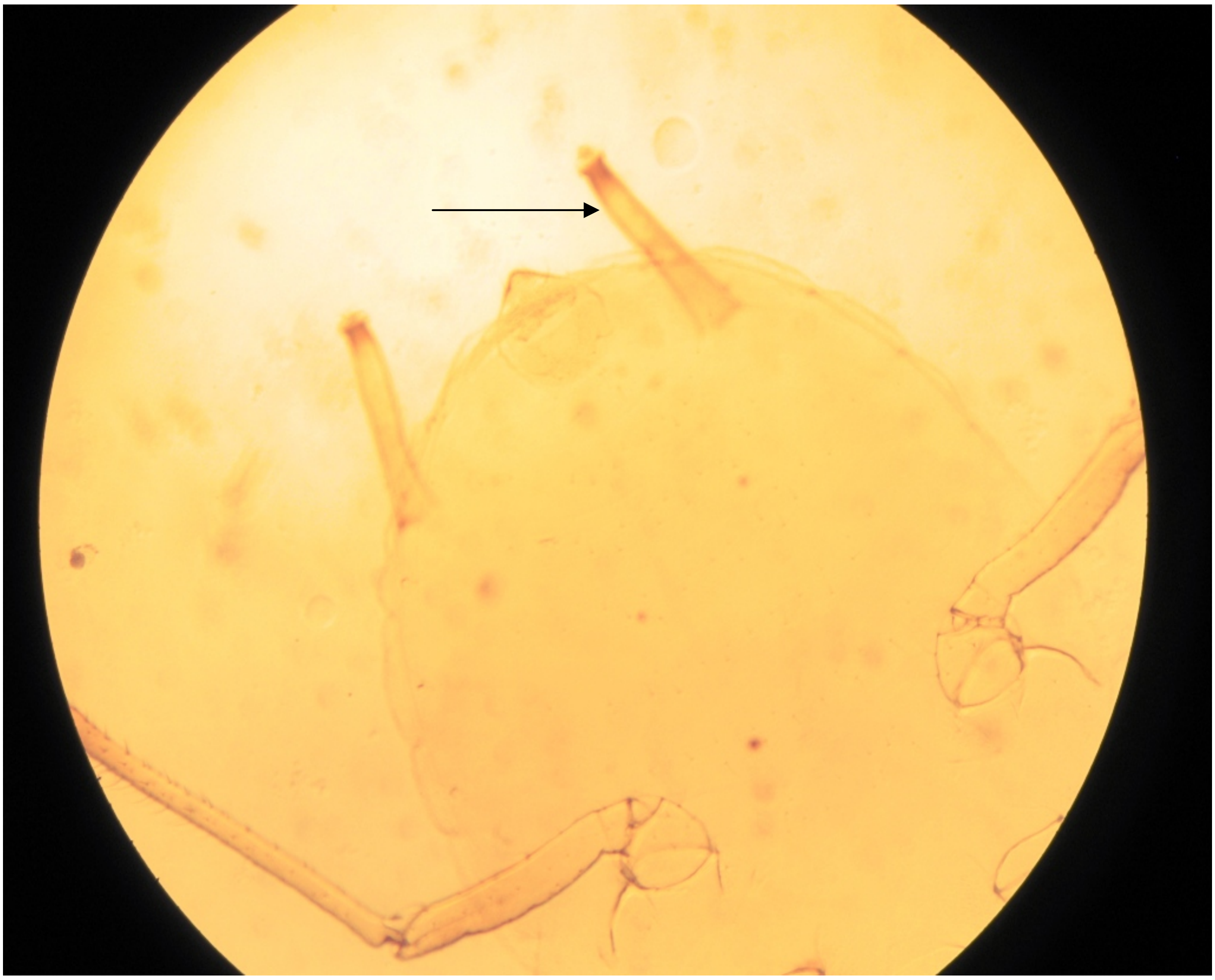


Plate (2):The wingless green peach aphid with slightly swollen cornicle (Sephinculus).

At Entomology Lab. Faculty of Agriculture in University of Jordan

2.1.b Hosts

The green peach aphid is highly polyphagous and has an extremely wide host range. In Jordan , Mustafa (1985,1986a,1986b) recorded this aphid on many host plants including tobaccos , tomatos , potatos , cucurbits , peppers , eggplants lettuce , corns , sorghums and many weeds, like common mallow , *Malva neglecta* , prickly lettuce, *Lactuca serriola* and flix weed , *Descurainian sophia* (Tamaki *et a*l.,1980). In Jordan Hamdan (1986) reported that pepper and lettuce were the preferred hosts in an experiment conducted in the field, while the preferred hosts in USA was radish ,*Raphanus sativus* (Anniss *et al.* , 1982).

2.1.c.Viruses transmitted by *Myzus persicae*

Many viral diseases on about 30 different plant families including main crops such as potatos, sugarbeets , surgarcanes , tobaccos , cucurbits and peppers are transmitted by this aphid (Van Emden *et al*.,1969). In Jordan ,it transmitted viral diseases to peppers (Bataresh, 1985), cucurbits (Dababat , 1985) and potatoes (Mnayer,1985). Furthermore , nonviroliferous holocyclic aphids that were fed on potentially viruliferous hosts transmitted beet western yellow virus to an average of 78% of the indicator plants , whereas an average of only 69% were infected by anholocyclic strain (Tamaki *et al*., 1982). Viruses transmitted by green peach aphid include alfalfa mosaic ,potato leaf roll , tomato yellow top, beet western yellows , cucumber mosaic, lettuce mosai , potato virus Y ,water melon mosaic virus , zucchini yellow mosaic.Green peach aphid may transmit infection from weed reservoirs harbouring viruses. In addition to the listed hosts , winged green peach aphids have also been found associated with redroot , oxtongue , chamomile chick weed, cleavers, hairy buttercup and scrambling speed well (Cameron and Fletcher , 2004) .

2.2.Pesticides Toxicity to *Myzus persicae*

Several resistant strains have been identified using molecular techniques. A form with a chromosomal translocation is widespread in glass houses and has been shown to have very high levels of resistance (Blackman and Devonshire 1978).

The green peach aphid , *Myzus persicae* is a species that often shows cases of decreased susceptibility to insecticides (Cravedi and Cervato ,1993). In Jordan Mustafa *et. al* (1989)and several workers in other parts of the world (Burbutis *et al.,* 1972 , Singh and Rataul *, 1990)* found that soil application of the granular insecticide carbofuran on pepper reduced the green peach aphid populations below that of the check plots . Various insecticides were reported to stimulate the reproduction of aphids (Lowery and Sears, 1986) . While others have been shown to negatively influence the reproduction of aphids (Lowery and Isman,1996). Green peach aphid reared in the laboratory on leaf disks of potato that were treated with a 550 ppm solution of azinphosmethyl produced 10% more offspring than on untreated disks, whereas the use of higher and lower concentrations did not produce more offspring than on untreated leaf disks (Lowery and Sears ,1986). In constrast, exposure of adults green peach aphid for 3 days to a 1% solution of neem seed oil applied to leaf disk of peppers reduced the number of alive offspring by 82% compared with the control. Similary, the azadirachtin , which is considered to be the most active component of neem reduced the fertility (alive offspring per aphid per day), in a linear concentration dependent manner (Lowery and Isman,1996). However, as far as we knows these proposed pesticides for testing against green peach aphid have not studied before locally and abroad in this toxicological comparison investigation.

Myzus persicae has developed various ways of surviving exposure to insecticides ,and because in the UK, female *Myzus persicae* generally reproduce only without mating (Partheno - genesis) large populations can build up quickly .

The next generation of aphids carries the same genes as their mothers, including any insecticide resistance traits. This form of reproduction continued through the winter in the glass houses and clamps and on out door weeds and crops such as oil seed rape, so carrying resistance forward to the following season. Although , there is an evidence that some insecticides resistant aphids do not survive cold UK winters very well , (Insecticide Resistance Action Group, 2004).

At present, three different resistance mechanisms are known in *Myzus persicae*:

2.2.a. **Esterases**:

Resistant aphids with this mechanism make increased amounts of enzymes called esterases ,which break down insecticides before they reach their target sites .This effect varies depending on the chemical structure of the insecticide. Resistance is greatest to organophosphorus (OP) insecticides although carbamates are also affected to a lesser extent . Aphids can contain different amounts of esterases so some are more resistant than others. They can be classed as susceptible (S) moderately resistant (R1), highly resistant (R2) or extremely resistant (R3). The level of esterases can be measured using biochemical or DNA -based tests (Insect Resistance Action Group ,2004).

2. 2.b Modified acetylcholine esterase (MACE):

OP and carbamate insecticides attack acetylcholinesterase , the enzyme that regulates the flow of a chemical messenger across the gap (synapse) between nerve cells This disruption kills the insect . In MACE aphids, the enzyme has become very specifically insensitive to the blocking effect of the dimethly carbamate pirimicarb

rendering the aphids immune to this insecticide. Aphids either have or do not have the MACE mechanism .It can also be detected by biochemical or DNA –based tests. (Insect Resistance Action Group ,2004).

2.2.c Knockdown resistance or (Kdr).

Pyrethroids act on another protein in the aphids nervous system called a sodium channel , which is responsible for the passage of signals along the nerve . The insecticides hold these channels open so that the nervous system becomes over-excited ,leading to the death of the insects. Aphids with Kdr contain a modified sodium channel protein , insensitive specifically to pyrethroids . The mechanism can be detected by a simple insecticide bioassay, although a DNA based test is now available . Aphids either do or do not have Kdr (Insect Resistance Action Group,2004).

3. Materials and Methods

3.1. Pesticides

Four Pesticides commonly used in Jordan for pepper protection were evaluated for their effects on green peach aphid, *Myzus persicae*.

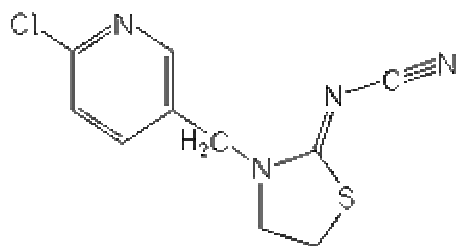
A fresh stock solution of each pesticide was prepared in tap water on each test day. All further dilutions were prepared from the stock solution . Tap water was used as control.

The pesticides used in this study as commercial formulations were:

1. Calypso 480 SC

It belongs to neonicotinoids chemical group . Common name is thiaclopried .

Trade name is Calypso 480SC. The mode of action acts as agonists of the acetylcholine receptor . That is they mimic the action of the neurotransmitter acetylcholine (Ach) (Insect Resistance Action Group, 2004). The structure and chemical name are as follows:

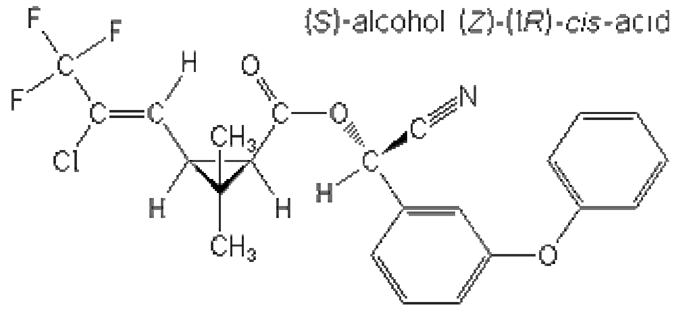


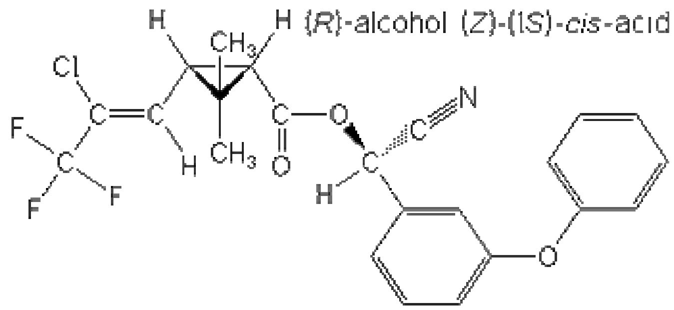
(Z)-3-(6-chloro-3-pyridylmethyl)-1,3-thiazolidin-2-ylidenecyanamide(Chemical Classes of Pesticides , 2011) .

2.Karate 5% EC

It belongs to pyrethroids. Common name is lamda- cyhalothrin. Trade name is. Karate 5%EC..The mode of action in this pesticides is acting on tiny channels through which sodium is pumped to cause excitation of neurons .They prevent the sodium channels from closing, resulting in continual nerve impulse trans-mission

tremors , and eventually death (Insect Rsistance Action Group,2004). The structure and chemical names are as follows:

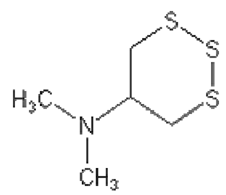




(R)-α-cyano-3-phenoxybenzyl(1S)-cis-3-[(Z)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropanecarboxylate and (S)-α-cyano-3-phenoxybenzyl (1R)-cis-3-[(Z)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropanecarboxylate.(Chemical Classes Of Pesticides ,2011) .

3.Evicect 50 SP

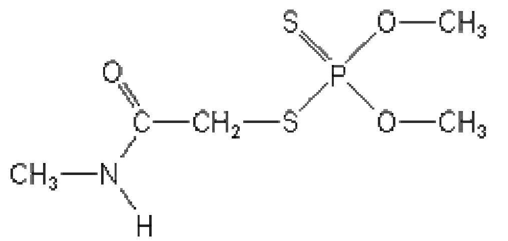
It belongs to trithiane.Common name is thiocyclam.Trade name is Eivsect 50 SP. The mode of action acts by the interruption of transmission of nerve impulses in the synapses of the nervous system .A few minutes pre-poisoned insects feel signs of paralysis leading to their death (Insect Resistance Action Group, 2004) . The structure and chemical name are as follows:



N, N-dimethyl-1,2,3-trithian-5-ylamine (Chemical Classes Of Pesticides , 2011)

4.Dimethoate 40 EC:

It belongs to organophosphates. Common name is Dimethoate .Trade names are Dimethoate , Aragol , Brimo , Roger 40 , …..etc. Dimethoete was used in the current study. The mode of action acts as cholinesterase inhibitors. They bind to the enzyme that is normally responsible for breaking down the acetylecholine (Ach) after it has carried its message across the synapse affecting the chloride channel by inhibiting GABA receptor (Insect Resistance Action Group,2004). The structure and chemical names are as follows:



O, O-dimethyl S-methy lcarbamoyl methyl phosphorodithioate . (Chemical Classes Of Pesticides , 2011) .

3.2 % Pesticides Formulations

The actual concentrations for the active ingredient for each pesticide formulation were checked in the Laboratory of Pesticides Formulation Analysis in (AL Baqa).

These are shown in Table(1). Prepared pesticides solution for testing the different strains, were carried out using the actual concentrations of the active ingredients.

Table (1) : % Concentrations of active ingredients of studied pesticides as shown on the label and as analyzed by the Laboratory of Pesticides Formulation Analysis .

Pesticide	Concentration on label	Actual concentration
Calypso 480SC	48%	48.45%
Karate 5%EC	5 %	4.81%
Evisect 50sp	50%	52.1%
Dimethoate 40 EC	40%	42.16%

3.3.Sweet Pepper Plant Production

Seeds of sweet pepper " California Wander " were continuously and regularly planted in seed trays until it reached 7-8 true leaves. The seedlings were transplanted in plastic pots containing 50% soil and 50% peatmoss, irrigated and fertilized as usual until they reached 30-35 cm in length.

3.4 Green Peach Aphid, *Myzus persicae* Culture

3.4.a.The susceptible population:

This population was collected from wild mustard (*Sinaps arvinsis* L. *)* (Crucifer) growing naturally in mountainous regions of Madaba (Aum - Al-Ammed) in Jordan away from insecticides uses 5-10 Km far from the nearest farming regions, then they were transferred in paper bags and maintained at the Entomology Laboratory , Plant Protection Department , Factuly of Agriculture , University of Jordan started in March 2010 .This aphid population was reared regularly on the peppers (see 3.5) in the lab where the temperature ranged from 25-30 C°. The plants were irrigated regularly when needed.

3.4.b Suspected resistant populations :

Two suspected resistant populations were collected from fields . The first was collected from peppers from Deir - Alla fields and the second population from peppers in Madaba. These collected populations were reared and maintained on pepper plants at the Entomology laboratory at Faculty of Agriculture in University of Jordan for testing their resistance to four insecticides. Temperature ranged from 25-30 C° .Apterous aphids (3-4th instars) were tested only.

Mounting of the green peach aphid on the slides were prepared for identification according to Blackman and Eastop (1994). Taxonomical confirmation was carried carried out by Dr. Tawfiq Al- Antary, the supervisor.

3.5 Aphid culture:

3.5.a Green house aphid culture

In the green house at Jordan University , a separated cabinet with 95cm width and 115cm long containing 50- 75 plants(Plate:5)were used for green peach aphid culturing .The temperature ranged from 25-35 C°. Infested leaves from the wooden cage (Plate 6) were taken after 3 weeks, distributed on the plants and then monitored daily. The plants and the aphid culture (Plate 7) were renewed after 4 - 5 months from aphid infestation.



Plate (3) : Green house aphid culture in the green house at the University of Jordan.



Plate (4) : Green house aphid cages at the University of Jordan

at the University of Jordan.

3.5.b. Lab aphid culture

In the lab at University of Jordan, three wooden cages(Plate 8) , each containing five pepper plants were infested with aphids collected from the green house culture. The plants were renewed regularly and when necessary, and from time to time infested leaves from green house culture were distributed on the plants .

This culture was kept during the whole period of the study and used for reinfestation of the newly established culture in the green house.



Plate (5) : Lab aphid stock culture at the University of Jordan.

3.5.c Lab conditions:

Rearing of the aphid in the Lab was conducted under the following conditions:

Temperature ranged between 24 -30 C˚, R.H. 60 -70% .

3.6 Laboratory assessments of pesticides toxicity to *Myzus persicae*

Preliminary tests including the control were done for each pesticide to determine the concentrations that would be used in this study. Pepper plants , 2-3 months old. Five concentrations of each pesticide with three replicates for each population were sprayed by a small hand sprayer on the pepper leaf in small Petri dishes as outlined by (Lowery and Simirle ,2003) .Tap water was used as control for each pesticide. Twenty apterous aphids (third or fourth instars) were removed with a fine brush from a leaf of infested pepper plants on which they were reared and placed on the pepper leaf in small Petri dishes lined with moistened cotton under the pepper leaf for each concentration , three replicates were treated and the number of alive aphid were recorded 24 hours after the treatment .

To assess mortality, aphids were touched lightly with a fine brush . If they responded normally by moving around their inserted stylets or by walking away they were considered as alive. They were considered as dead if :

1) Their stylets were inserted into the leaf and they failed to move their legs or antennae when touched.
2) The stylets were not inserted and they were unable to move or walk when touched.

3.7 The effect of pesticides on longevity and fecundity of *Myzus persicae* for three generations

3.7.a. The residual effect of four pesticides on survived aphids and their offspring under lab conditions

This experiment was carried out during the period between Oct.4 to Nov.15, 2010 in the lab. Average temperature and relative humidity fluctuations during this period ranged between 23-28 C° and relative humidity 65-70%.

One hundred of 3rd and 4th nymphal instars of the green peach aphid were placed by camel hair brush on four pepper plants in a wooden cage (see **3.5.a**).

There were four replicates for each pesticide and the control. The sprayed pesticides were Calypso 480SC ,Karate 5EC, Evisect 50SP and Dimethoate 40EC .They were separately sprayed at the obtained LC50 from the previous experiment . Number of survived aphids were counted weekly from Oct.4 to Nov.15, 2010 . The plants were 60 days old .Tap water was used to be sprayed as a control treatment .

3.7.b The effect of pesticides on longevity and fecundity of *Myzus persicae* for three generations under green house conditions

This experiment was carried out during the period between Nov.24 to Dec.30, 2010 , in the green house. Average temperatures during this period ranged 18 – 22 C° and relative humidity was 60-65%.

One hundred of 3rd and 4th nymphal instars of the green peach aphid were placed using moistened camel hair brush, on four pepper plants in wooden cage for each insecticide and control . The aphids were treated with the LC 50 dose separately for each pesticide. The pesticides were Calypso 480SC, Karate 5EC , Evisect 50 SP , Dimethoate 40 EC . Clip on cage (Plate 9) was used to keep one adult aphid inside .The clip on cage consisted of two halves of circular plastic with 2.5 cm in diameter . The

sides were covered with fine muslin. The edges were lined with circular rubber to open and close tightly with hair clips and not to allow the caged aphid to escape (Plates 9,10 and11). There were 15-30 cages (replicates) for each pesticide and control. The aphids were treated with the LC50 dose separately for each pesticide . The pesticides wrere Calypso 480SC, Karate 5 EC, Evisect 50SP, Dimethoate 40 EC..The pepper plants were 60 days old .Tap water was used to be sprayed as a control. Longevity and fecundity were recorded for three generations by recording longevity and fecundity as follows.

3.7.b.1 Longevity

In a wooden Cage , there were 15-30 Clip on cages . Each cage contained one new born nymph (one day old) until becoming adult and then death . The given nymphs from one of these adults were observed until death. The time recorded from birth to death was considered the longevity .The mean was calculated, for the adults of first generation .The procedure was repeated for the three generations separately for each insecticide and its control .

3.7.b.2 Fecundity

In a wooden cage, there were15-30 Clip on cages . Each cage contained one new born nymph (one day old) until becoming adult and then death .The given nymphs from one adult of these adults were observed until giving new nymphs. The given nymphs were counted until the mother death .The number of nymphs were given by one female adult was considered the fecundity. The mean was calculated, for the adults of first generation . The procedure was repeated for the three generations separately for each insecticide and its control.

3.8 Statistical methods :

Data was subjected to probit analysis using SPSS 13.00 computer program (Hareware, 2000) for toxicity experiments was used for toxicity analysis , and SAS program (SAS,2002) for longevity and fecundity experiments



Plate (6): The used Clip on cage



Plate (7): The Clip on cage placed on the leaf of the pepper plant in the green house in the University of Jordan .



Plate (8): Several Clips on cages placed on the leaves of the pepper plant in the green house in the University of Jordan .

4. Results

4.1 Toxicity of the pesticides against *Myzus persicae*

Data analysis for the toxicity experiments has been constructed in Tabels(2,3,4,5) to facilitate comparison between different pesticides used in the experiment . Goodness of line fitting was checked by Chi -square test $\aleph^2$. Referring to Finney (1971) the value of $\aleph^2$ at 0.05 level of probability equals to 1,084 , 0.433 and1.28 at 3 degrees of freedom (df) for sensitive population , Deir- Alla population and Madaba population, respectively, for Calypso 480 SC, 0.121 , 1.72 and 1.54 at 3 df for sensitive population , Deir –Alla population and Madaba population ,respectively, for Karate 5%EC , 1.23 , 3.29 and 1.21 at 3 df for sensitive population , Dier-Alla population, and Madaba population ,respectively ,for Evisect 50 sp . 0.98, 4.13 and 0.75 at 3 df for sensitive population , Deir-Alla population , and Madaba population, respectively , for Dimethoate.

4.1.1 Calypso toxicity to *Myzus persicae:*

Comparison between the LC50 of Calypso for three populations of *Myzus* persicae (Table 2) showed that the lowest LC50 is for sensitive population (26.5) , followed by Madaba population (34.33), then Dier-alla population (34.97). LC50 for Madaba population and Deir-alla field population were not significantly different (95%Cl did not over lap).While LC50 for the two populations when compared with LC50 for sensitive population were found significantly different.Y value for each line estimated by probit regression was equal zero when LC50 (x) was converted to log base 10.

Tabel (2):Calypso toxicity to three populations of *Myzus persicae* under lab conditions in Jordan

Population	LC50 ppm*	95% CL1	LC90 ppm**	95% CL	L.E.P.R2	Slope±SE	R.F ***
Sensitive	26.5b	21.9- 30.1	68.13a	56.6- 93.9	Y= - 4.45 + 3.13(x)	3.13 ±0.49	
Madaba	34.33a	30.9-37.7	73.23a	62.4-94.5	Y=-5.98+3.90(x)	3.90 ±0.51	1.30
Deir-alla	34.97a	30.3-39.6	100.14a	76.7-166.5	Y=-4.33+2.80(x)	2.80 ±0.47	1.32

1= 95% confidence limits for LC_{50} in ppm.

2=L.E.P.R. line estimated by probit regression .

*=LC_{50} values in ppm in the same column having different letters are significantly different at 95% level did not over lap

**=LC_{90} values in ppm in the same column having different letters are significantly different at 95% level did not over lap

*** = LC_{50} value in ppm of field population divided by LC_{50} value in ppm of sensitive population ,lower resistance factor indicates that pesticides are more toxic, the population with lower resistance.

4.1.2 Karate toxicity to *Myzus persicae:*

Comparision between the LC50 of the Karate for three populations of *Myzus persicae* (Tabel3), showed that the lowest LC50 is for sensitive population (4.73) , followed by Madaba population (6.26), then Deir-alla population (18.34) , LC50 for Madaba population with sensitive population was found not significantly different (95% CL did not overlap), whileLC50 for Deir-alla population with LC50 for sensitive population was found significantly different. Y value for each line estimated by probit regression was equal to zero when LC50 (x) was converted to log base 10.

Tabel (3): Karate toxicity to three populations of *Myzus persicae* under lab conditions in Jordan

Population	LC_{50} ppm*	95% CL1	LC_{90} ppm**	95% CL	L.E.P.R.2	Slope ±SE	R.F***
Sensitive	4.73b	3.9-5.7	19.89b	14.6-32.6	Y=-1.38+2.05(x)	2.05±0.26	
Madaba	6.26b	5.3-7.5	24.35 ab	17.7-40.3	Y=-1.73+2.17(x)	2.17±0.27	1.32
Deir-alla	18.34a	16.6-20.3	40.17a	33.6-54.o	Y=-4.78+3.78(x)	3.78±0.52	3.88

1= 95% confidence limits for LC_{50} in ppm.

2=L.E.P.R. line estimated by probit regression .

*=LC_{50} values in ppm in the same column having different letters are significantly different at 95% level did not over lap

**=LC_{90} values in ppm in the same column having different letters are significantly different at 95% level did not over lap

***= LC_{50} value in ppm of field population divided by LC_{50} value in ppm of sensitive population ,lower resistance factor indicates that pesticides are more toxic, the population with lower resistance.

4.1.3 Evisect toxicity to *Myzus persicae*

Comparision between the LC_{50} of Evisect for three populations of *Myzus persicae:*

(Tabel 4) showed that the lowest LC_{50} is for sensitive population (0.42), followed by Madaba population (1.37), then Deir-alla population (2.13) .LC50 for sensitive population, Madaba population, and Deir- Alla population, were found significantly different . Y value for each line estimated by probit regression was equal to zero when LC_{50} (x) was converted to log base 10 .

Tabel (4): Evisect toxicity to three populations of *Myzus persicae* under lab conditions in Jordan

Population	LC_{50} ppm*	95% CL1	LC_{90} ppm**	95% CL	L.E.P.R.2	Slope ±SE	R.F***
Sensitive	0.42 c	0.31-0.55	3.60 a	2.24-7.72	Y =0.52+1.37(x)	1.37 ±0.18	
Madaba	1.37 b	1.11-1.67	6.43 a	4.60-10.86	Y=-.26+1.91(x)	1.91±0.24	3.26
Deir-alla	2.13 a	1.79-2.49	7.45 a	5.78-10.89	Y=-0.77+2.36(x)	2.36±0.28	5.07

1= 95% confidence limits for LC_{50} in ppm.

2=L.E.P.R. line estimated by probit regression .

*=LC_{50} values in ppm in the same column having different letters are significantly different at 95% level did not over lap

**=LC_{90} values in ppm in the same column having different letters are significantly different at 95% level did not over lap.

***= LC_{50} value in ppm of field population divided by LC_{50} value in ppm of sensitive population ,lower resistance factor indicates that pesticides are more toxic, the population with lower resistance.

4.1.4 Dimethoate toxicity to *Myzus persicae*

Comparision between the LC_{50} of the Dimethoate for three populations of *Myzus-persicae* (Tabel 5) showed that lowest LC_{50} is for sensitive population (0.5) followed by Madaba population (2.18), then Deir-alla population (17.95) .LC_{50} for sensitive strain, Madaba population, and Deir-alla population ,were found significantly different . Y value for each line estimated by probit regression was equal to zero when LC_{50} LC_{50} (x) was converted to log base 10.

Tabel (5): Dimethoate toxicity to three populations of *Myzus persicae* under lab conditions in Jordan

Population	LC_{50} ppm*	95% CL1	LC_{90} ppm**	95% CL	L.E.P.R.2	Slope ±SE	R.F***
Sensitive	0.50c	0.37-0.68	5.98b	3.11-20.47	Y=0.36+1.19(x)	1.19±0.20	
Madaba	2.18b	1.93-2.54	6.13b	4.49-11.40	Y=-0.97+2.86(x)	2.86±0.50	4.36
Deir-alla	17.95a	16.2-19.70	37.97a	32.17-49.65	Y=-4.94+3.94(x)	3.94±0.53	35.9

1= 95% confidence limits for LC_{50} in ppm.

2=L.E.P.R. line estimated by probit regression .

*=LC_{50} values in ppm in the same column having different letters are significantly different at 95% level did not over lap

**=LC_{90} values in ppm in the same column having different letters are significantly different at 95% level did not over lap

***= LC_{50} value in ppm of field population divided by LC_{50} value in ppm of sensitive population, lower resistance factor indicates that pesticides are more toxic, the population w

ith lower resistance.

4.2 The residual effect of the pesticides on survived aphids and their offsrings under lab conditions

4.2.1 Calypso with sensitive population:

Number of the aphids and offspring aphids after one week of spraying with the estimated LC_{50} (26.5 ppm) of Calypso were 22 aphids, and zero offspring aphids(Fig.1). The number of aphids decreased to13 and zero for the following 2 weeks, while the number of offspring aphids increased to 12 , 15 . This number of aphids and offspring aphids remained constant to the end of the experiment for sensitive strain (Fig. 1).

4.2.2 Calypso with Deir- Alla population:

Number of the aphids and offspring aphids after one week of spraying with the estimated LC_{50} (34.33 ppm) of Calypso were 20 aphids, and zero offspring aphids (Fig.2).The number of aphids decreased to 15 and zero for the following 2 weeks ,while the number of offspring aphids increased to 11 , 13 . This number of aphids and offspring aphids remained constant to the end of the experiment (Fig.2).

4.2.3 Calypso with Madaba population:

Number of the aphids and offspring aphids after one week of spraying with the estimated LC_{50} (34.97 ppm) of Calypso were 17 aphids , and zero offspring aphids (Fig.3) .

The number of aphids decreased to 11 and zero for the following 2 weeks while the number of offspring aphids increased to 13 , 15. The number of aphids and offspring aphids remained constant to the end of the experiment (Fig.3).

4.2.4 Karate with sensitive population:

Number of the aphids and offspring aphids after one week of spraying with lab estimated LC_{50} (4.73 ppm) of Karate were 37 and zero offspring aphids (Fig. 4). The

number of aphids were decreased to 22,18,11 and 8 for the second, third, fourth and fifth weeks, respectively, while the number of the offspring aphids were increased 20,29,33 and 35 , respectively, (Fig.4).

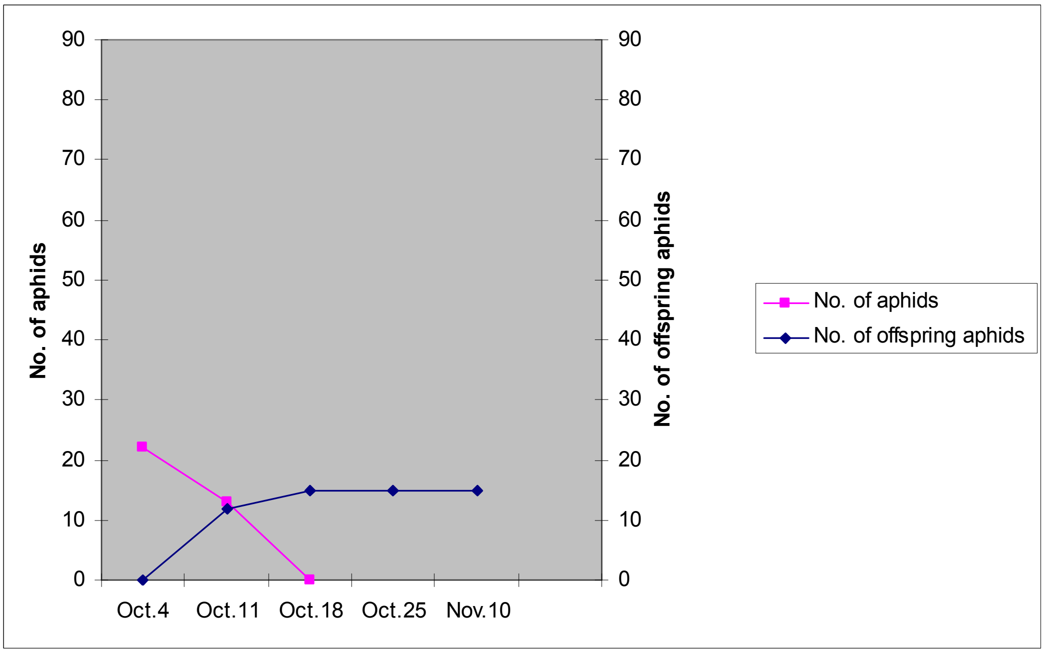


Figure (1): Weekly mean numbers of aphids and offspring aphids per wooden cage for Calypso treatment with sensitive population during Oct.4 to Nov.15,2010

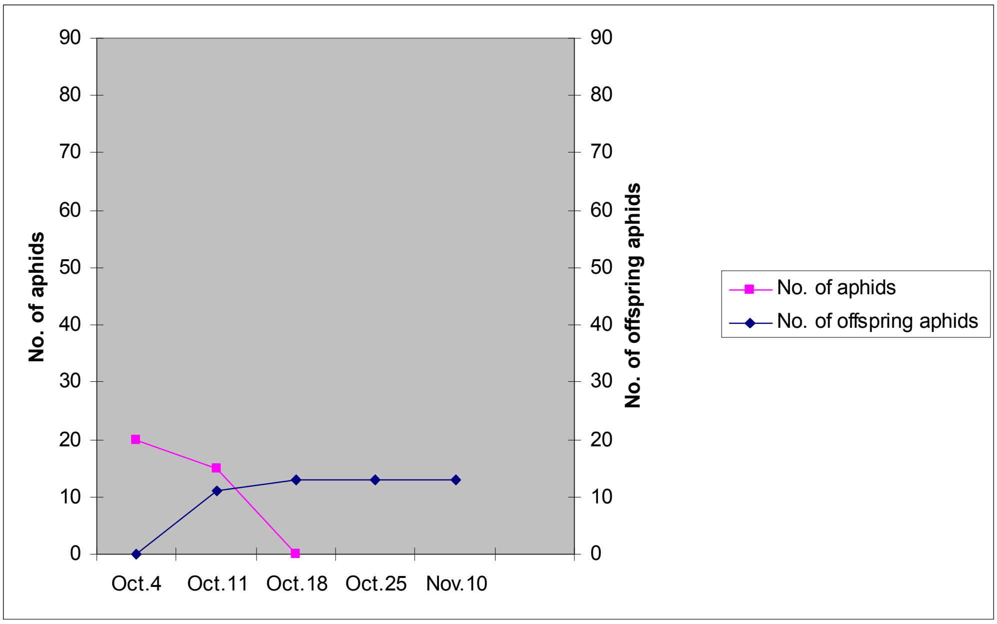


Figure (2): Weekly mean numbers of aphids and offspring aphids per wooden cage for Calypso treatment with Deir-Alla population during Oct.4 to Nov.15,2010

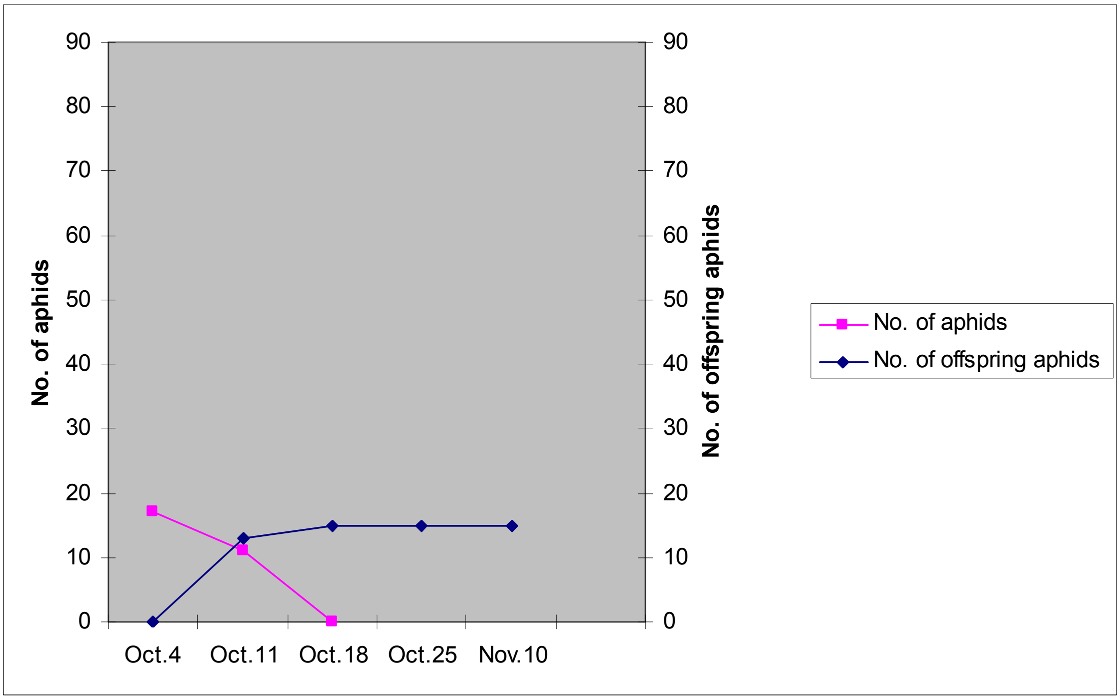


Figure (3): Weekly mean numbers of aphids and offspring aphids per wooden cage for Calypso treatment with Madaba population during Oct.4 to Nov.15, 2010

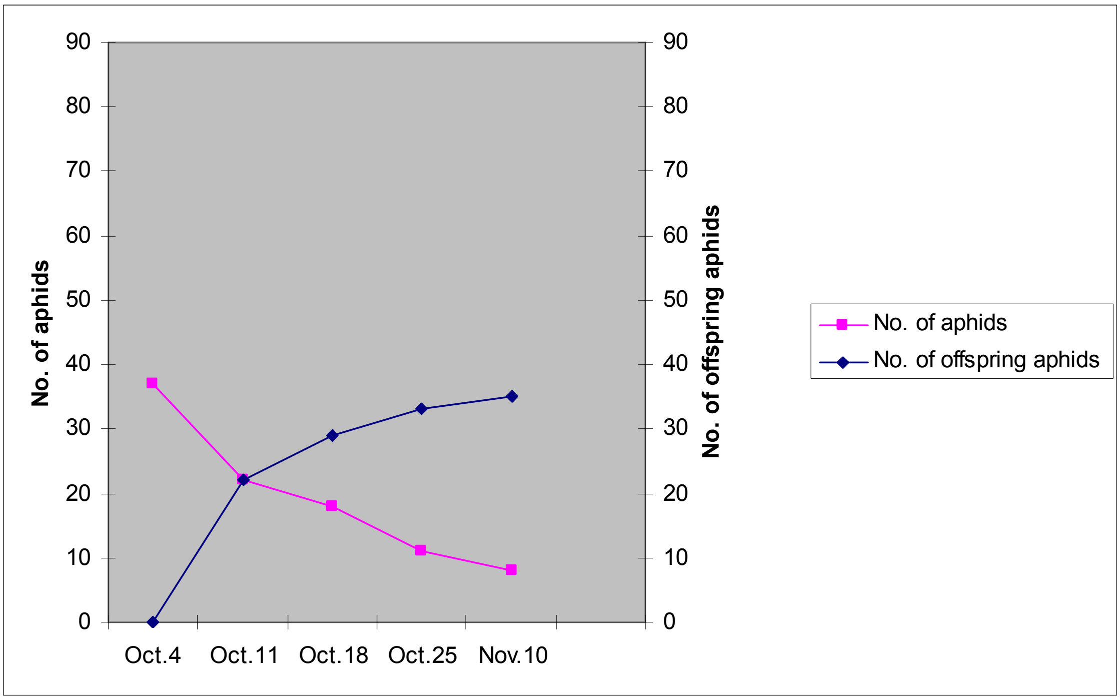


Figure (4): Weekly mean numbers of aphids and offspring aphids per wooden cage for Karate treatment with sensitive population during Oct.4 to Nov.15, 2010

4.2.5 Karate with Deir – Alla population:

Number of the aphids and offspring aphids after one week of spraying with lab estimated LC50 (6.26 ppm) of Karate were 32 and zero offspring aphids (Fig.5) . The number of aphids decreased to 27,23,17 and 12 for the second, third, fourth and the fifth weeks ,respectively, while the number of offspring aphids increased 25 , 37 , 42 , and 45 , respectively, (Fig.5)

4.2.6 Karate with Madaba population:

Number of the aphids and offspring aphids after one week of spraying with lab estimated LC50 (18.34 ppm) of Karate were 37 and zero offspring aphids (Fig. 6). The number of aphids decreased to 25, 22 , 13 and 11 for the second , third, fourth and fifth weeks ,respectively, while the number of offspring aphids increased 22 , 27 , 32 and 35, respectively, (Fig.6).

4.2.7 Evisect with sensitive population:

Number of aphids after one week of spraying with lab estimated LC50 (0.42 ppm) of Evisect were 49 and zero offspring aphids (Fig.7) .The number of aphids decreased to 32 23 , 11 and 9 for the second , third , fourth and fifth weeks ,respectively, while the number of offspring aphids increased to 27 , 29 , 32 and 35 ,respectively,(Fig.7).

4.2.8 Evisect with Deir- Alla population:

Number of aphids after one week of spraying with lab estimated LC50 (1.37 ppm) of Evisect were 55 and zero offspring aphids (Fig.8) .The number of aphids decreased to 35 27, 15 and 9 for the second ,third ,fourth and fifth weeks ,respectively, while the number of offspring aphids increased to 32 , 35 , 37 and 39 ,respectively,(Fig.8).

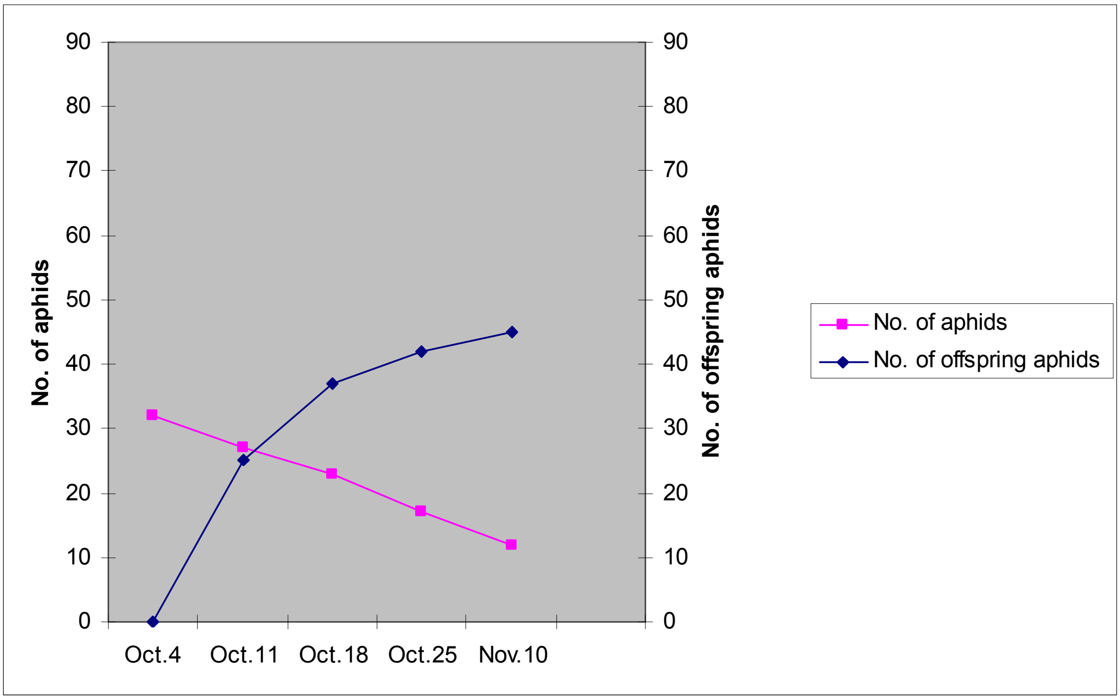


Figure (5): Weekly mean numbers of aphids and offspring aphids per wooden cage for Karate treatment with Deir-Alla population during Oct.4 to Nov.15, 2010.

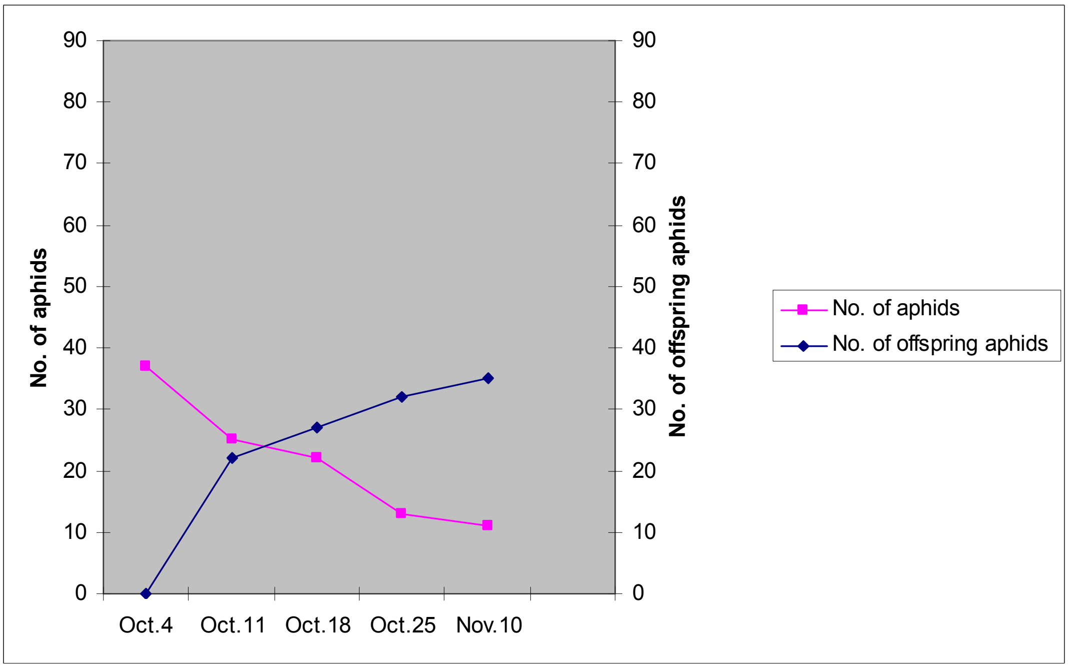


Figure (6): Weekly mean numbers of aphids and offspring aphids per wooden cage for Karate treatment with Madaba population during Oct.4 to Nov.15, 2010

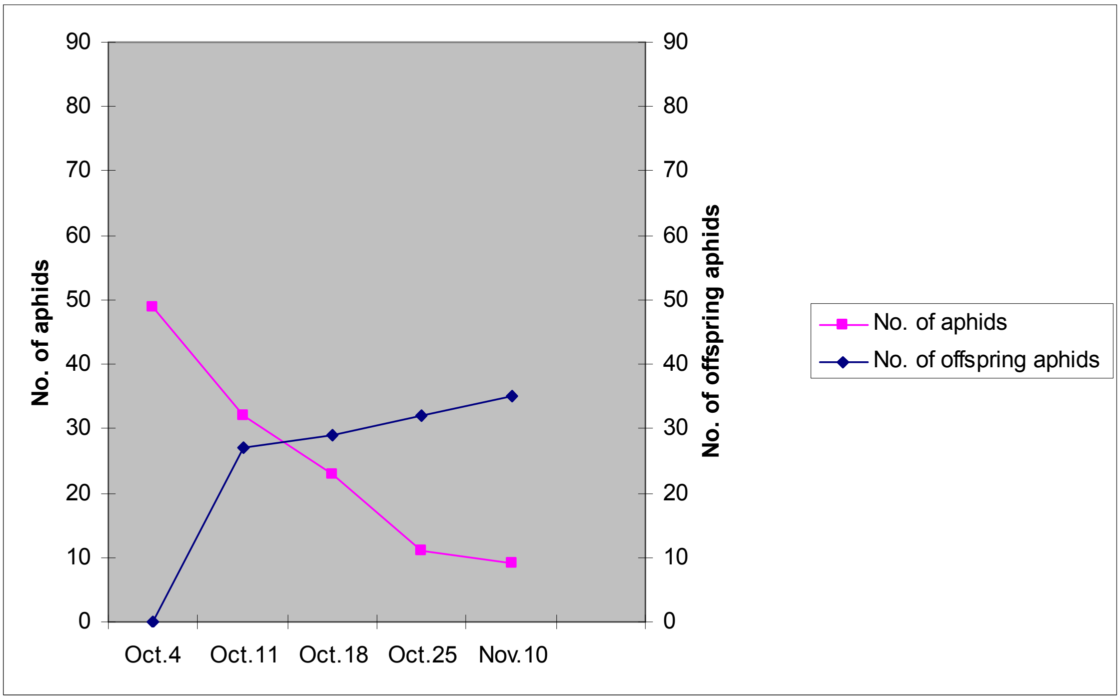


Figure (7): Weekly mean numbers of aphids and offspring aphids per wooden cage for Evisect treatment with sensitive population during Oct.4 to Nov.15, 2010

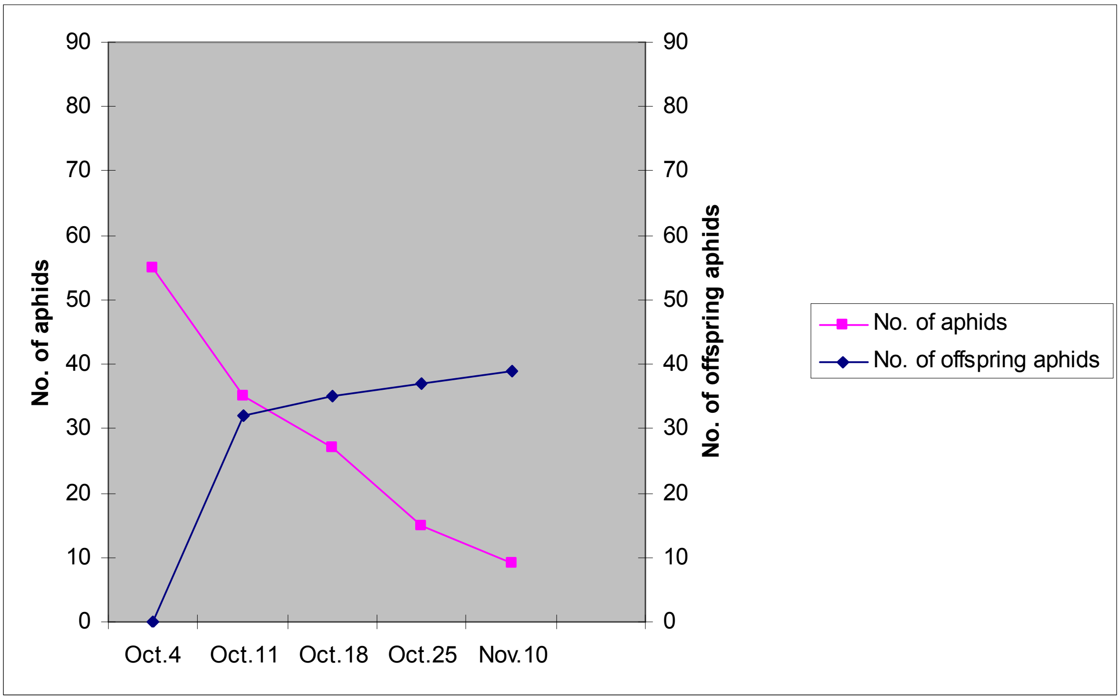


Figure (8): Weekly mean number of aphids and offspring aphids per wooden cage for Evisect treatment with Deir-Alla population during Oct.4 to Nov.15, 2010

4.2.9 Evisect with Madaba population:

Number of aphids after one week of spraying with lab estimated LC50 (2.13 ppm) of Evisect were 52 and zero offspring aphids(Fig.9) .The number of aphids decreased to 37 ,29 , 21 and 9 for the second ,third , fourth and fifth weeks ,respectively, while the number of offspring aphids increased to 28 ,34 ,42 and 45 ,respectively,(Fig.9).

4.2.10 Dimethoate with sensitive population:

Number of aphids and offspring aphids after one week of spraying with lab estimated LC50(0.50 ppm) of Dimethoate were 70 aphids and zero offspring aphids (Fig.10) The number of aphids decreased to 34, 19, 10 and 8 for the second third ,fourth and fifth weeks ,respectively, while the number of offspring aphids increased to 39, 41, 47 and 49 ,respectively,(Fig.10).

4.2.11 Dimethoate with Deir- Alla population:

Number of aphids and offspring aphids after one week of spraying with lab estimated LC50 (2.18 ppm) of Dimethoate were 79 aphids and zero offspring aphids (Fig.11). The number of aphids decreased to 44, 29, 20 and 10, respectively, while the number of offspring aphids increased to 40, 58 , 66 and 88,respectively, (Fig.11).

4.2.12 Dimethoate with Madaba population:

Number of aphids and offspring aphids after one week of spraying with lab estimated LC50 (17.95 ppm) of Dimethoate were 77 aphids and zero offspring aphids (Fig.12) The number of aphids decreased to 42 ,19, 10 and 8 for the second ,third ,fourth and fifth weeks ,respectively, while the number of offspring aphids increased to 52, 60,65 and 78 ,respectively,(Fig.12).

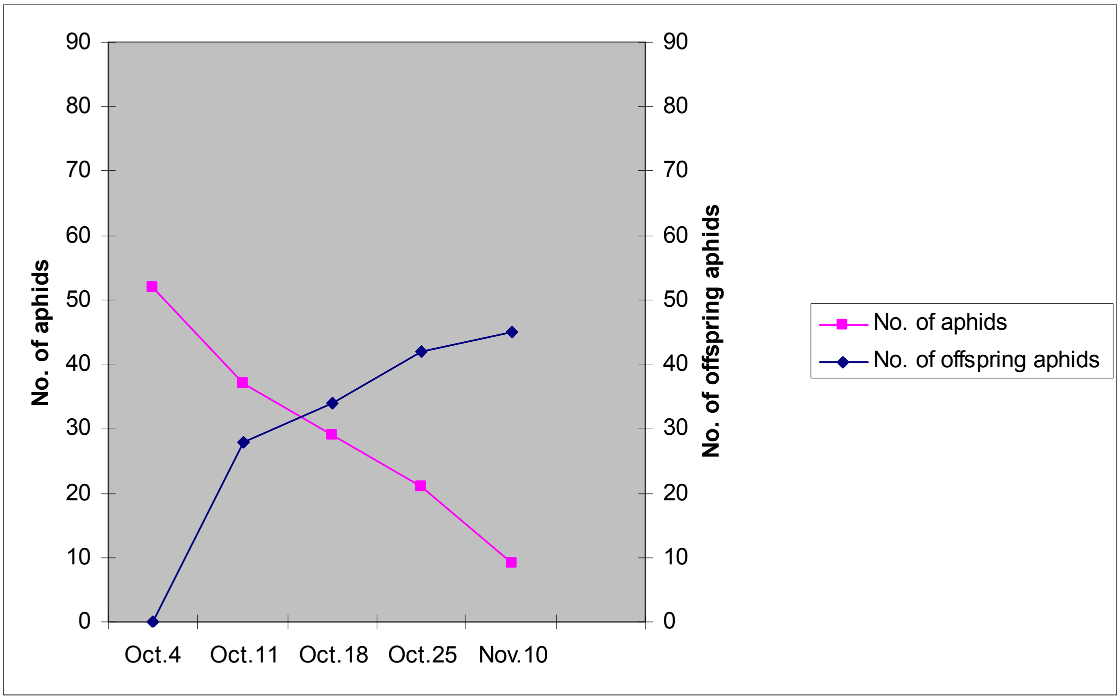


Figure (9): Weekly mean numbers of aphids and offspring aphids per wooden cage for Evisect treatment with Madaba population during Oct.4 to Nov.15, 2010

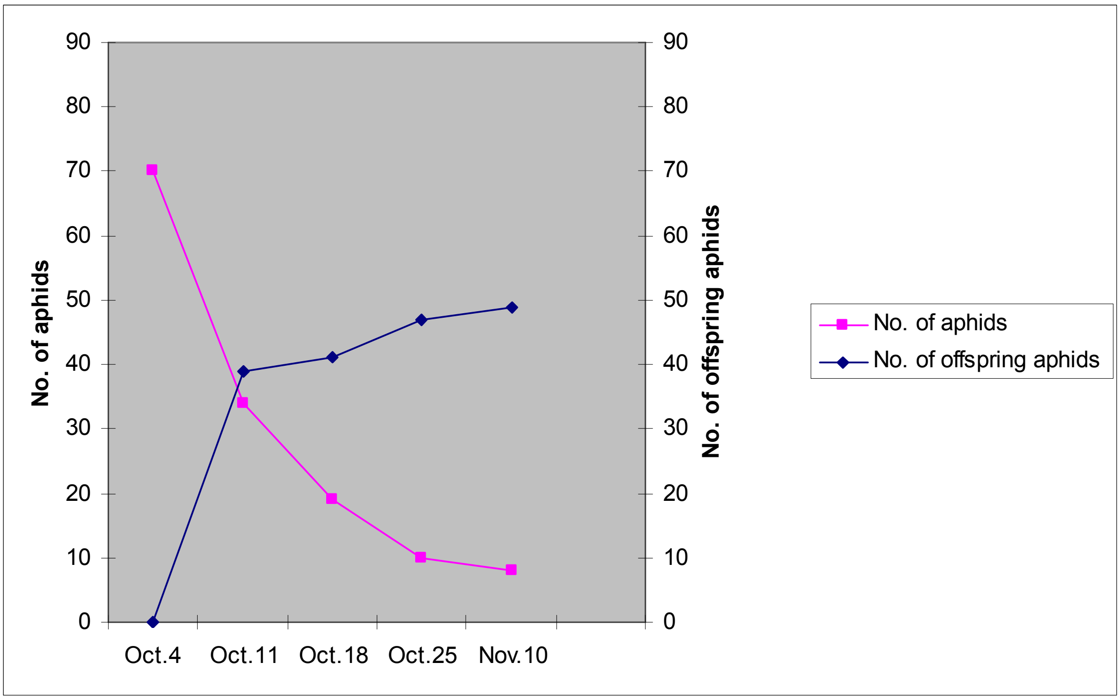
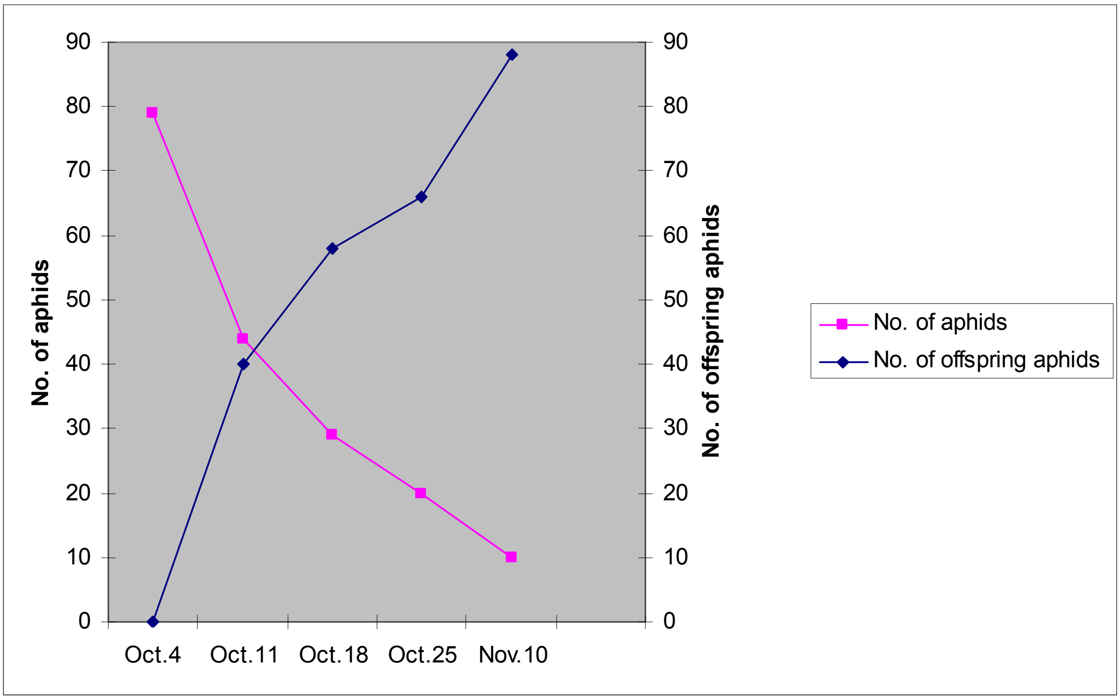


Figure (10): Weekly mean numbers of aphids and offspring aphids per wooden cage for Dimethoate treatment with sensitive population during Oct.4 toNov.15,2010



Figure(11): Weekly mean numbers of aphids and offspring aphids per wooden cage for Dimethoate treatment with Deir-Alla population during Oct.4 to Nov.15,2010

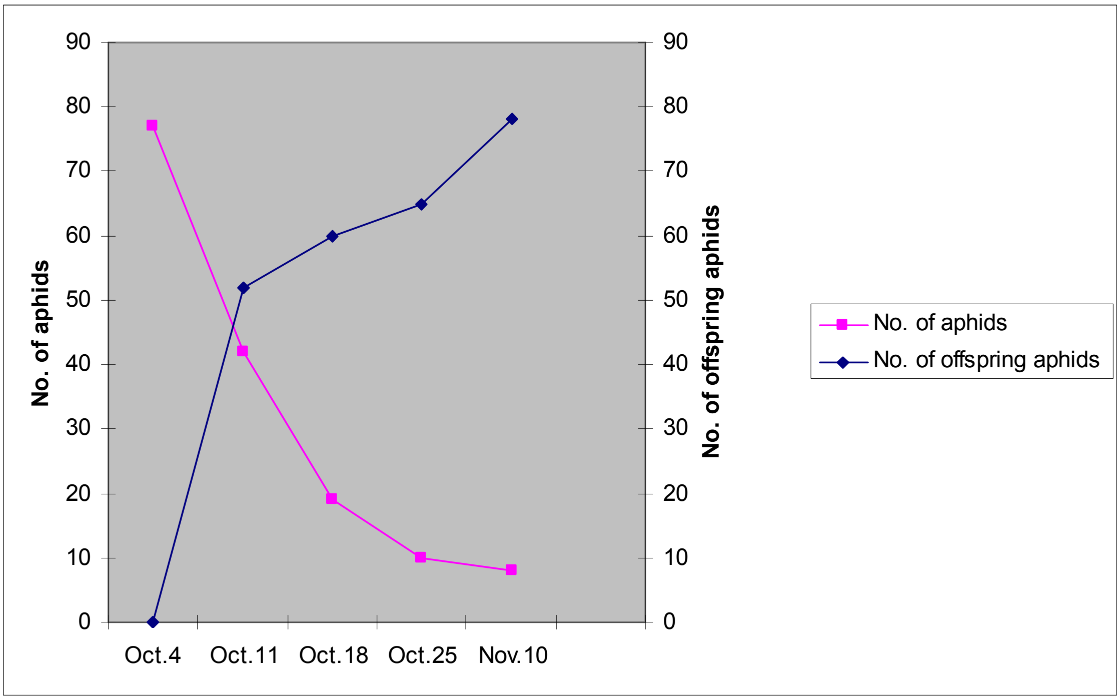


Figure (12): Weekly mean numbers of aphids and offspring aphids per wooden cage for Dimethoate treatment with Madaba population during Oct.4 to Nov.15, 2010

4.2.13 Control treatment:

In the control treatment number of aphids and offspring aphids after one week of spraying with Tap water were 95 aphids and zero offspring aphids(Fig.13) .The number of aphids decreased to 52,40,38 and 29 for the second ,third, fourth and fifth weeks ,respectively, while the number of offspring aphids increased to 51, 63, 71 and 98, respectively, (Fig.13).

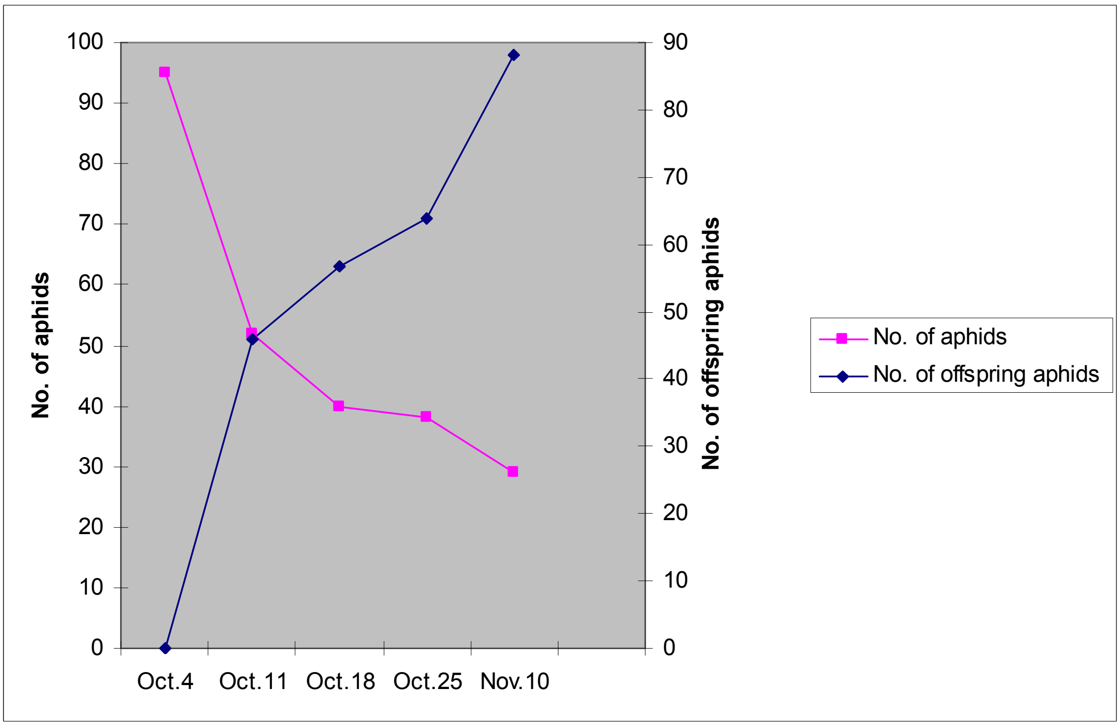


Figure (13): Weekly mean numbers of aphids and offspring aphids per wooden cage for Control treatment during Oct.4 to Nov.15 , 2010

4.3 The effect of pesticides on longevity and fecundity of *Myzus persicae* for three generations under green house conditions

4.3.1 The effect of Calypso on longevity and fecundity of *Myzus persicae*

4.3.1.a The effect of Calypso on the longevity of *Myzus persicae* :

For the sensitive population, there were significant differences in longevity between the first, second and third generations (8.1, 8.6, 8.8) days, respectively, at 0.05%level . The highest longevity was significantly occurred in the third generation (Table 6).

For the Deir-Alla population ,there were significant differences between longevity in the first and second generations (8.5 , 8.9) ,but there was no significant difference between second and third generations (8.9 ,8.9). at 0.05% level. However, the highest longevities were in the second and third generations (Table 6).

For the Madaba population, there were significant differences between the first ,second and third generations (7.9 , 8.6 , 9.2) , respectively, at 0.05% level . The highest longevity was significantly occurred in the third generation (Table 6).

4.3.1.b The effect of Calypso on the fecundity of *Myus persicae* :

For the sensitive population, there were significant differences between fecundity in the first and second generations (79.2, 82.1), but there was no significant difference between second and third generations (82.1 , 83.9) , at 0.05% level. However , the highest fecundity was in the third generation (Table 6).

For the Deir-Alla population, there were significant differences between fecundity in the first and second generations (88.1 , 93.4) , but there was no significant difference between fecundity in the second and third generations (93.4 , 94.2) , at 0.05% level. However, the highest fecundity was in the third generation (Table 6).

For the Madaba population, there was significant difference between fecundity in the first, second and third generations (78.3 , 80.3 , 83.4) ,respectively, at 0.05% level. However, the highest fecundity for green peach aphid was in the third generation (Table 6).

Table(6):The effect of Calypso on longevity and fecundity of *Myzus persicae* for three generations under green house conditions in Jordan

Generation	Population	*L ± SE	*F ± SE
1st generation	Sensitive	8.1±1.2d	79.2±1.9d
	Deir – Alla	8.5±1.0c	88.1±2.0b
	Madaba	7.9±1.6d	78.3±1.6e
	Control	7.3±1.0e	89.7±1.0b
2nd generation	Sensitive	8.6±1.9c	82.1±1.2c
	Deir Alla	8.9±2.0b	93.4±1.9a
	Madaba	8.6±1.2c	80.3±1.2d
	Control	7.1±0.0e	89.5±1.0b
3rd generation	Sensitive	8.8±1.9b	83.9±2.2c
	Deir –Alla	8.9±1.6b	94.2±2.5a
	Madaba	9.2±1.9a	83.4±1.9c
	Control	7.0±0.0e	89.8±0.0b

Means within the same column with the same letter are not significantly different using LSD at 0.05% level.

*L : The mean of the longevity in days

**F: The mean of fecundity in numbers

4.3.2 The effect of Karate on longevity and fecundity of *Myzus persicae*

4.3.2.a The effect of Karate on the longevity of *Myzus persicae* :

For the sensitive population, there was no significant difference between longevity in first and second generations (8.4 ,8.3) , but there was significant difference between second and third generations (8.3 , 7.9) at 0.05% level. However, the highest longevity was in the third generation (Table 7).

For the Deir-Alla population, there was no significant difference between longevity in first and second generations (8.2,8.1), but there was significant difference between longevity in the second and third generations (8.1 , 7.2) , at 0.05% level. However, the highest longevity was in the first generation (Table 7).

For the Madaba population, there were significant differences between longevity in first, second and third generations (8.5 , 8.2 , 7.9),respectively, at 0.05% level. The highest longevity significantly occurred in the first generation (Table 7).

4.3.2.b The effect of Karate on the fecundity of *Myzus persicae* :

For the sensitive population, there were significant differences between fecundity in first ,second and third generations (74.3 , 63.9 , 57.8) , respectively, at 0.05% level. However, the highest fecundity occurred in the first generation (Table 7).

For the Deir-Alla population, there were significant differences between first , second and third generations (73.9 , 70.6 , 65.3) ,respectively, at 0.05%level.However, the highest fecundity occurred in the first generation (Table 7).

For the Madaba population, there were significant differences between fecundity in first, second and third generations (69.7 , 64.5 , 56.1) , respectively, at 0.05%level. However the highest fecundity occurred in the first generation (Table 7).

Table (7):The effect of Karate on longevity and fecundity of *Myzus persicae* for three generations under green house conditions in Jordan

Generation	Population	*L ± SE	*F ± SE
1st generation	Sensitive	8.4±1.9c	74.3±1.2b
	Deir – Alla	8.2±1.2d	73.9±1.9b
	Madaba	8.5±1.6c	69.7±1.0c
	Control	8.9±1.2b	89.7±1.0a
2nd generation	Sensitive	8.3±1.6d	63.9±1.6d
	Deir-Alla	8.0±1.9e	70.6±1.6c
	Madaba	8.2±2.2d	64.5±1.9d
	Control	9.3±0.0a	89.9±1.0a
3rd generation	Sensitive	7.9±1.6e	57.8±1.2e
	Deir-Alla	7.2±1.6f	65.3±1.2d
	Madaba	7.9±1.9e	56.1±2.5e
	Control	9.1±1.0a	90.2±1.0a

Means within the same column with the same letter are not significantly different using LSD at 0.05.

* L : The mean of Longevity in days

**F : The mean of Fecundity in number

4.3.3 The effect of Evisect on longevity and fecundity of *Myzus persicae*

4.3.3.a The effect of Evisect on the longevity of *Myzus persicae* :

For the sensitive population, there were no significant differences between longevity in first, second and third generations (9.1 , 9.0 , 9.2) ,respectively , at 0.05% level. However, the highest longevity was in the third generation (Table 8).

For the Deir-Alla population, there were no significant differences between longevity in first, second and third generations (9.2 ,9.1 ,9.0) , respectively , at 0.05% level. However, the highest longevity was in the first generation (Table 8).

For the Madaba population, there were no significant differences between longevity in first and second third generations (9.0 , 9.0 ,9.3) ,respectively, at 0.05% level. However, the highest longevity was in the third generation (Table 8).

4.3.3.b The effect of Evisect on the fecundity of *Myzus persicae* :

For the sensitive population, there was significant difference between fecundity in first, second generations (68.9 ,70.8) , and between first and third generation (68.9 ,71.1),but there was no significant difference between fecundity in second and third generations (70.8,71.1) at 0.05% level. However, the highest fecundity was in the third generation (Table 8).

For the Deir-Alla population, there were no significant differences between fecundity in first, second and third generations (85.6, 86.1, 86.9), respectively, at 0.05 level. However the highest fecundity was in the third generation (Table 8)

For the Madaba population, there was significant difference between fecundity in the first and second generations (88.9,89.7), but there was no significant difference between fecundity in first and third generations (88.9,88.8), at 0.05% level .However the highest fecundity was in the second generation (Table 8).

Table (8):The effect of Evisect on longevity and fecundity of *Myzus persicae* for three generations under green house conditions in Jordan

Generation	Population	*L + SE	*F + SE
1st generation	Sensitive	9.1+1.9b	68.9+1.9f
	Deir – Alla	9.2+1.2b	85.8+1.6d
	Madaba	9.0+1.6b	88.9+1.2c
	Control	9.8+1.0a	90.2+0.0a
2nd generation	Sensitive	9.0+2.2b	70.8+2.5e
	Deir-Alla	9.1+2.5b	86.1+1.5d
	Madaba	9.0+1.9b	89.7+1.9b
	Control	9.3+1.0b	90.2+0.0a
3rd generation	Sensitive	9.2+1.6b	71.1+1.6e
	Deir-Alla	9.0+2.0b	86.9+2.0d
	Madaba	9.3+1.9b	88.8+2.8c
	Control	9.0+0.0b	90.3+1.0a

Means within the same column with the same letter are not significantly different using LSD at 0.05.

*L : The mean of Longevity in days

**F : The mean of Fecundity in numbers

4.4.4 The effect of Dimethoate on the longevity and fecundity of *Myzus persica*

4.4.4.a The effect of Dimethoate on the longevity of *Myzus persicae* as shown in table (9):

For the sensitive population, there were significant differences between longevity in first, second and third generations (9.1 ,9.6 ,10.0) ,respectively , at 0.05% level. However, the highest longevity was significantly occurred in the third generation (Table9).

For Deir-Alla population, there was significant difference between longevity in second and third generations (9.0 ,97) but there was no significant difference between longevity in second and third generations (9.7, 9.7) at 0.05%level. However, the highest longevity was in the 2nd and 3rd generations (Table 9).

For the Madaba population, there was significant difference between longevity in first and second generations (9.1 ,9.7),but there was no significant difference between longevity in second and third generations (9.7,9.7) at 0.05%level. However, the highest longevity was in the 2nd and 3rd generations (Table 9).

4.4.4.b The effect of Dimethoate on the fecundity of *Myzus persicae* :

For the sensitive population, there was significant difference between fecundity in first and second generations (68.9 , 75.8), but there was no significant difference between second and third generations (75.8,76.1) at 0.05%level .However the highest longevity was in the third generation (Table 9) .

For the Deir-Alla population, there were significant differences between fecundity in first ,second and third generations (84.9 ,87.8 ,88.7) at 0.05% level .However the highest fecundity was in the third generation (Table 9).

For the Madaba population, there were significant differences between fecundity in first, second and third generations (85.2 ,87.0,88.9) at 0.05%level. However, the highest fecundity was in the third generation (Table 9).

Table (9): The effect of Dimethoate on longevity and fecundity of *Myzus persicae* for three generations under green house conditions in Jordan:

Generation	Population	*L ± SE	*F ± SE
1st generation	Sensitive	9.1±1.6c	68.9±1.6f
	Deir – Alla	9.0±1.2c	84.9±1.9d
	Madaba	9.1±1.0c	85.2±1.2d
	Control	9.6±0.0b	90.8±1.0a
2nd generation	Sensitive	9.6±1.9b	75.8±1.9e
	Deir Alla	9.7±2.0b	87.8±2.8c
	Madaba	9.7±1.0b	87.0±2.2c
	Control	10.0±1.0a	90.7 ±0.0a
3rd generation	Sensitive	10±2.6a	76.1±1.9e
	Deir –Alla	9.7±1.6b	88.7±1.6b
	Madaba	9.7±1.9b	88.9±1.2b
	Control	10.1±1.0a	90.9±1.0a

Means within the same column with the same letter are not significantly different using LSD at 0.05.

*L : The mean of Longevity in days

**F : The mean of Fecundity in numbers

5. Discussion

The LC50 values and the 95% confidence limits were calculated from probit regressions using the SPSS 13.00 computer program (Hareware,2000). The pesticide with the lowest LC50 did not indicate that it was the best one. The LC50 for Calypso was 34.97 ppm, Karate 18.34 ppm, Evisect 2.13 ppm and Dimethoate 17.95 ppm . Resistance factors (RF) were calculated by dividing the LC50 value in ppm of field population by LC50 value in ppm of sensitive population. This base line LC50 served as a reference for the calculation of resistanc factors for Calypso, Karate , Evisect and Dimethoate in *Myzus persicae* populations. Lower resistance factor indicates that the pesticides was more toxic .Resistance factor for Calypso 1.32,Karate 3.88,Evisect 5.07 and Dimethoate 35.9. These results indicated that *Myzus persicae* field populations (Madaba and Deir-all) were relatively more resistance against Dimethoate when compared with the other pesticides (Calypso, Karate,Evisect). Generaly speeking, Dimethoate was the least toxic against *Myzus persicae* than the other pesticides (Calypso, Karate , Evisect) , in this study . Foster *et al*. (1997) indicated that *Myzus persicae* shows extreme resistance to Pirimicarb from carbamates compared to Dimethoate from organophosphates ,despite both insecticides acting on the same target site which is acetyl cholene esterase enzyme in the synaps.This high lights the importance of knowing the pesticide group of resistance mechanisms are present in an aphid population on the crop prior to insecticide application ,and in addition supports relatively the failure of Dimethoate and some of other insecticides noted by Jordanian farmers, to control green peach aphid . However, when a pesticide fails to provide control the aphid. at a concentration that formely was effective, it is a case of suspected resistance (McClanahan and Founk,1983). In fact, during the past few years Jordanian farmers have noticed frequent failure of organophosphate (OP) , pyrethroid insecticides and carbmates against

infestation with the green peach aphid on many crops. It is evident that prolonged use of these insecticides did increase the degree of tolerance in aphids population although vegetable crops received frequent applications of pesticides directed against white fly , thrips ,leafminer, and spider-mite (Abed-Allwali,2000). The suspected resistance of *Myzus persicae* to (OP) was not surprising since it had been reported in different countries (Attia and Hamilton ,1978, Bolsinger *et al*.,1993 , Foster *et al*., 1997, Nauen *et al*.,1996, and Wauters and Dewar,1995).

High levels of resistance to many insecticides , including pyrethroids, is wide spread in many populations of *Myzus persicae* throughout the world (Devonshire, 1989). Field and lab toxicity evaluation of Pyrethroid insecticides against aphids populations revealed contradictory results (Attia and Hamilton, 1978, Collar *et al*.,1997, Dewar *et al*., 1998, and Unruh *et al*., 1996). The LC50 for Deltamethrin Cypermethrin , Fenvalerate and Permethrin to *Myzus persicae* colonies, from Canada during1972 –1980 were in the range of 54–113 , 65 – 412 , 17 – 327 and 29 – 656 ppm , respectively, (McClanahan and Founk, 1983) . Whereas the LC50 for Esfenvalerate using two different clones of *Myzus persicae* were 19.6 and 40.8 ppm (Unruh et al., 1996). However ,in this study, Karate LC50 was 18.34 ppm and LC90 40.17 ppm.

From the experiment of residual effect of insecticides on survived aphids and their offspring under lab condition , the relatively high percentage reduction achieved even one week after treatment with Calypso in comparison with other pesticides .

It was much more when applied directly to aphids on infested plants . The life processes of any insect are affected by chemical factors, such as the use of insecticide and physical factors such as temperature , humidity ,wind , evaporation and light ,and also affected by biotic factors such as their food , their natural enemies or for competitors for food.

In the longevity and fecundity experiment , the results showed that exposure to Calypso (neonicotinoid) increased relatively the longevity and fecundity of green peach aphid in the 2nd and 3rd generations . This might be due to the speed of egg hatch, and the total of egg hatch. However, it is known that the sublethal doses of many insecticides stimulate pest resurgence in the filed . It is usually due to the suppression of a natural enemy or the reproductive stimulation of pests (Mores and Zareh 1991, Nandihalli *et al*. 1992, Nemoto 1993). However, in laboratory experiments, James and Price (2002) reported a significant increase in egg production in *T. urticae* after spray with systemic applications of Imidacloprid (neonicotinoid) at field –relevant rates for hop yards . In contrast , significantly reduced oviposition in *T. urticae* following drench or foliar applications of imidacloprid and ascetamiprid at field-relevant rates was reported in another study (Ako *et al*. 2004). Ako *et al*. (2006) suggested that the ovipositional response of *T. urticae* to field –recommended doses of imidacloprid is strain-dependent. It is generally understood that imidacloprid and ,most likely, neonicotinoids in general ,used at their field-recommended rates, are not the sole factors contributing to the propagation of mite pests by oviposition stimulation , and one possible explanation currently under investigation is interspecies competition . The Karate (pyrethroid) decreased the longevity and the fecundity of *Myzus persicae* in this study .These results agreed with those of Abo El-Ghar and El- Sayed (1992),who tested five different insecticides against the cabbage aphid *Brevicoryne. brassicae* (L.) , and its associated parasitoid *Diaeretiella. rape* (M Intosh) . They reported that the pyrethroids were preferable to the organophosphate insecticides , due to their minimal adverse effects on the emergence of parasitoids from mummified aphids and their subsequent survival, longevity and fecundity , when applied at rates a little below the recommended field rates. Hsieh and Allen (1986) , with both organophosphate and pyrethroid insecticides ,

found that increased dose of each insecticides reduced fecundity . They also reported that organophosphate insecticides were more active and suppressed the fecundity of *D. rape* at most doses when compared with pyrethroids. El –Sayed and Abo El-Ghar (1989) reported that increased doses of organophosphate , pyrethroid and carbamate insecticides reduced fecundity of *D. rapae*. They also reported that parasitoid fecundity was better with pyrethroid than organophosphate insecticides.

6. Conclusions and Recommendations

6.1 Conclusions

Laboratory tests of four pesticides Calypso, Karate, Evisect and Dimethoate against three strains of *Myzus persicae*, the sensitive strain and the two field strains Deir-Alla and Madaba revealed the following conclusions:

1. All the tested populations were resistant to Dimethoate.The resistance factors ranged from 4.36 to 35.9 . At its high recommended field rate, Dimethoate was ineffective in controlling *Myzus persicae.*
2. The LC50 to Myzus persicae for the pesticides Calypso, Karate, Evisect and Dimethoate were 34.97 , 18.34 , 2.13 , 17.95 ,respectively, whereas the LC90 for the same pesticides in arrangement were 100.14 , 40.17 , 7.45 , 37.97 ,respectively.
3. The LC50 value in ppm of field population divided by LC50 value in ppm of sensitive population (the resistance factor) for Calypso, Karate , Evisect and Dimethoate were 1.32 , 3.88 , 5,07 , 35.9 ,respectively, the lower RF indicates that pesticide was more toxic .
4. Dimethoate was ineffective in controlling *Myzus persicae* for the two field populations.
5. Karate was moderately fair in controlling *Myzus persicae* for the two field populations.
6. Evisect was good in controlling *Myzus persicae* for the two field populations.
7. Calypso was a very useful pesticide giving a high efficacy and long lasting effect against *Myzus persicae* .
8. Calypso led to significant increase in longevity and fecundity of green peach aphid.

9. Karate led to significant decrease in longevity and fecundity of green peach aphid in the 2nd and 3rd generations.
10. Evisect led to a little increase in fecundity of green peach aphid, but their was no affect on the longevity of green peach aphid, in the 2nd and 3rd generations.
11. Dimethoate led to increase in longevity and fecundity of green peach aphid in the 2nd and 3rd generations, but the percentage increased less than Calypso but more than Evisect.

6.2 Recommendations

In order to avoid the resistance development by *Myzus persicae* to pesticides and to get high quality of pepper product, the following are recommended:

1. Applying pesticides that have different active ingredients and different mode of actions.
2. Studying the mechanisms of resistance to pesticides is very important to prevent cross resistance between closely related groups of pesticides.
3. Regular monitoring should be carried out to detect the extent of resistance to the pesticides used by farmers **.**
4. Restricting the use of pesticides to which the magnitude of resistance is high like Dimethoate .
5. Trainig farmers on alteration of pesticides based on mode of action to facilitate long term sustainable *Myzus persicae* management in Jordan.
6. Some insecticides such as Calypso and Dimethoate might increase longevity and fecundity of the green peach aphid leading to the population resurgence.
7. The use of different insecticides concerning their mode of action might reduce the resurgence of the aphid population.

8. Positive or negative effect of pesticides on longevity and fecundity of the aphid is useful in IPM programs.

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8. Tables and appendix

Tables :

Table (1): Total and expected response to Calypso on sensitive population of *M. persicae*

No.	Concentration Ppm	No. Tested	No. Responding	No. Expected	Total Response	Total Expected
1	60	60	54	52.218		
2	50	60	48	48.683		
3	40	60	42	43.229	201	201.161
4	30	60	33	34.789		
5	20	60	24	22.242		
	0 (control)	60	1			

Table (2) :Total and expected response to Calypso on Dier-Alla population of *M. persicae*

No.	Concentration ppm	No. Tested	No. Responding	No. Expected	Total Response	Total Expected
1	60	60	45	44.983		
2	50	60	39	40.501		
3	40	60	36	34.424	162	161.939
4	30	60	27	26.245		
5	20	60	15	15.786		
	0 (Control)	60	1			

Table (3) :Total and expected response to Calypso on Madaba population of *M. persicae*

No.	Concentration ppm	No. Tested	No. Responding	No. Expected	Total Response	Total Expected
1	60	60	51	49.860		
2	50	60	45	44.573		
3	40	60	33	36.600	168	168.13
4	30	60	27	25.297		
5	20	60	12	11.807		
	0 (Control)	60	2			

Table (4):Total and expected response to Karate on sensitive population of *M. persicae:*

No.	Concentration ppm	No. Tested	No. Responding	No. Expected	Total Response	Total Expected
1	15	60	51	51.178		
2	10	60	45	45.328		
3	5	60	33	32.046	165	164.94
4	3	60	22	21.716		
5	2	60	14	14.672		
	0 (Control)	60	2			

Table (5) :Total and expected response to Karate on Deir-Alla population of *M. persicae*

No.	Concentration ppm	No. Tested	No. Responding	No. Expected	Total Response	Total Expected
1	30	60	50	47.716		
2	25	60	42	42.119		
3	20	60	31	34.087	158	158.249
4	15	60	22	23.283		
5	10	60	13	11.044		
	0 (Control)	60	2			

Table (6) :Total and expected response to Karate on Madaba population of *M. persicae:*

No.	Concentration ppm	No. Tested	No. Responding	No. Expected	Total Response	Total Expected
1	15	60	48	48.076		
2	10	60	39	40.831		
3	5	60	30	26.003	141	140.879
4	3	60	15	15.981		
5	2	60	9	9.988		
	0 (Control)	60	1			

Table (7) :Total and expected response to Evisect on sensitive population of *M. persicae:*

No .	Concentration ppm	No. Tested	No. Responding	No. Expected	Total Response	Total Expected
1	2.5	60	53	51.554		
2	1	60	42	42.256		
3	0.5	60	31	33.110	163	163.305
4	0.25	60	22	23.557		
5	0.1	60	15	12.828		
	0(Control)	60	1			

Table (8) :Total and expected response to Evisect on Deir-Alla population of *M.persicae:*

No.	Concentration ppm	No. Tested	No. Responding	No. Expected	Total Response	Total Expected
1	7	60	56	53.435		
2	5	60	45	48.756		
3	2.5	60	34	34.429	173	173.084
4	1.5	60	25	22.358		
5	1	60	13	14.106		
	0(Control)	60	1			

Table (9):Total and expected response to Evisect on Madaba population of *M.persicae*

No.	Concentration ppm	No. Tested	No. Responding	No. Expected	Total Response	Total Expected
1	6	60	55	53.567		
2	3	60	43	44.987		
3	1.3	60	30	29.154	166	166.201
4	1	60	23	24.929		
5	0.5	60	15	13.564		
	0 (Control)	60	2			

Table (10) :Total and expected response to Dimethoate on sensitive population of *M. persicae:*

No.	Concentration ppm	No. Tested	No. Responding	No. Expected	Total Response	Total Expected
1	2	60	45	46.181		
2	1	60	39	38.984		
3	0.5	60	33	30.817	156	155.88
4	0.25	60	24	22.661		
5	0.15	60	15	17.237		
	0 (Control)	60	2			

Table (11):Total and expected response to Dimethoate on Deir-Alla population of *M.persicae:*

No.	Concentration ppm	No. Tested	No. Responding	No. Expected	Total Response	Total Expected
1	30	60	52	48.951		
2	25	60	44	43.385		
3	20	60	30	35.170	162	162.411
4	15	60	22	23.880		
5	10	60	14	11.025		
	0 (Control)	60	2			

Table (12) :Total and expected response to Dimethoate on Madaba population of *M.persicae:*

No.	Concentration ppm	No. Tested	No. Responding	No. Expected	Total Response	Total Expected
1	3	60	42	39.849		
2	2.5	60	33	34.813		
3	2	60	27	28.409	135	135.066
4	1.5	60	21	20.494		
5	1	60	12	11.501		
	0 (Control)	60	1			

Appendix (1):

```
* * * * * * * * * * * * *  P R O B I T    A N A L Y S I S  * * * * * *

DATA  Information

          5 unweighted cases accepted.
          0 cases rejected because of missing data.
          0 cases are in the control group.
          0 cases rejected because LOG-transform can't be done.
MODEL Information

      ONLY Normal Sigmoid is requested.


 Parameter estimates converged after 11 iterations.
 Optimal solution found.

 Parameter Estimates (PROBIT model:  (PROBIT(p)) = Intercept + BX):

           Regression Coeff.  Standard Error     Coeff./S.E.

   dose_ppm          3.12508          .49153         6.35780


                   Intercept  Standard Error  Intercept/S.E.

                    -4.44781          .76648        -5.80290

  Pearson  Goodness-of-Fit  Chi Square =      1.084    DF = 3   P =
.781

  Since Goodness-of-Fit Chi square is NOT significant, no
heterogeneity
  factor is used in the calculation of confidence limits.
```

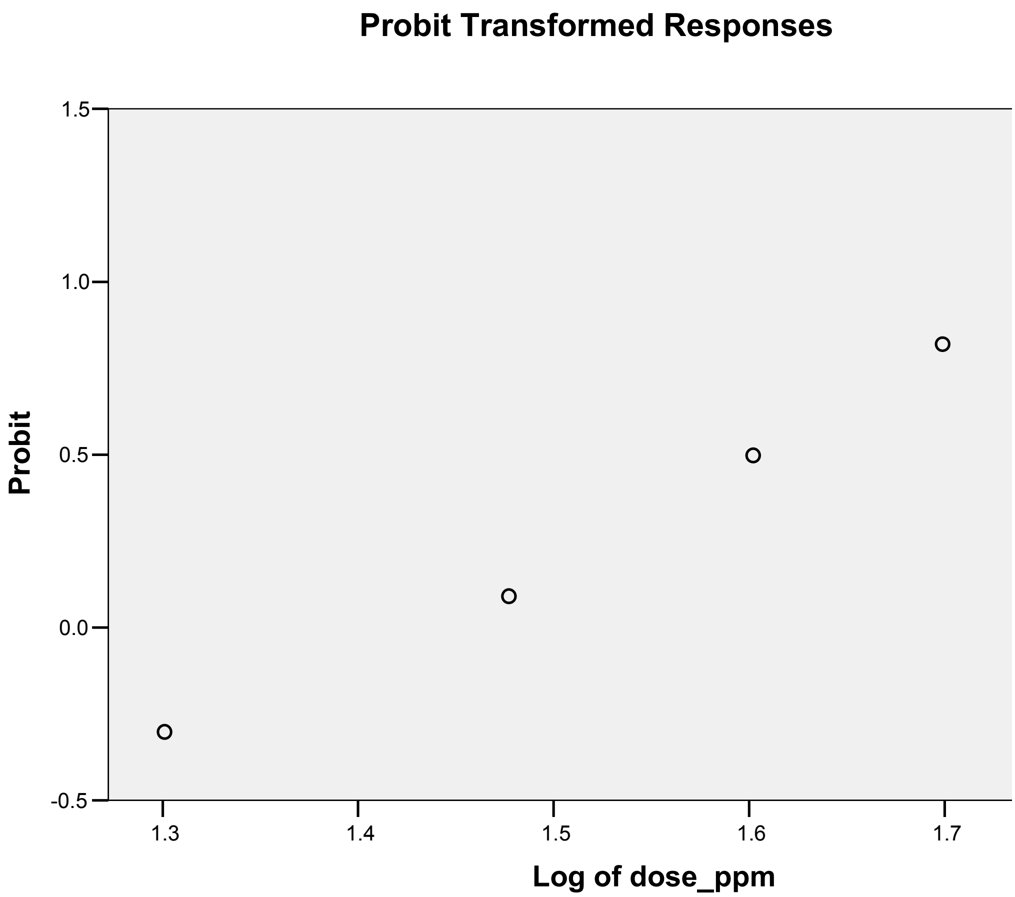
* * * * * * * * * * * * P R O B I T   A N A L Y S I S * * * * * * * * *

Observed and Expected Frequencies

dose_ppm	Number of Subjects	Observed Responses	Expected Responses	Residual	Prob
1.78	60.0	54.0	52.218	1.782	.87031
1.70	60.0	48.0	48.683	-.683	.81138
1.60	60.0	42.0	43.229	-1.229	.72048
1.48	60.0	33.0	34.789	-1.789	.57982
1.30	60.0	24.0	22.242	1.758	.37070

Confidence Limits for Effective dose_ppm

Prob	dose_ppm	95% Confidence Limits Lower	Upper
.01	4.77366	1.93001	7.74515
.02	5.83554	2.57719	9.04113
.03	6.62865	3.09575	9.97508
.04	7.29556	3.55320	10.74171
.05	7.88722	3.97445	11.40934
.06	8.42847	4.37187	12.01088
.07	8.93352	4.75266	12.56496
.08	9.41136	5.12144	13.08331
.09	9.86809	5.48142	13.57380
.10	10.30808	5.83488	14.04207
.15	12.34848	7.55424	16.16657
.20	14.25450	9.26861	18.09523
.25	16.12251	11.03789	19.94744
.30	18.00777	12.90155	21.79082
.35	19.95099	14.89241	23.67592
.40	21.98846	17.04149	25.65046
.45	24.15757	19.37943	27.76901
.50	26.50109	21.93559	30.10364
.55	29.07197	24.73434	32.75933
.60	31.93985	27.78940	35.89672
.65	35.20167	31.10385	39.76038
.70	39.00028	34.69465	44.70528
.75	43.56072	38.65077	51.23957
.80	49.26923	43.20374	60.17784
.85	56.87404	48.83334	73.11585
.90	68.13180	56.62029	93.99442
.91	71.16959	58.64319	99.93667
.92	74.62344	60.91068	106.83985
.93	78.61491	63.49230	115.00535
.94	83.32565	66.49093	124.89145
.95	89.04377	70.06803	137.23955
.96	96.26515	74.49811	153.35503
.97	105.95036	80.30538	175.83686
.98	120.35017	88.69589	210.99105
.99	147.12151	103.66490	281.39488


Probit Transformed Responses
1.5
1.0
0.5
0.0
-0.5
Probit
1.3
1.4
1.5
1.6
1.7
Log of dose_ppm

* * * * * * * * * * * * P R O B I T   A N A L Y S I S * * * * * * * * *

DATA Information

5 unweighted cases accepted.
0 cases rejected because of missing data.
0 cases are in the control group.
0 cases rejected because LOG-transform can't be done.

MODEL Information

ONLY Normal Sigmoid is requested.

Parameter estimates converged after 10 iterations.
Optimal solution found.

Parameter Estimates (PROBIT model: (PROBIT(p)) = Intercept + BX):

	Regression Coeff.	Standard Error	Coeff./S.E.
dose_ppm	2.80486	.47439	5.91254

	Intercept	Standard Error	Intercept/S.E.
	-4.32982	.75140	-5.76231

Pearson Goodness-of-Fit Chi Square = .433 DF = 3 P = .933

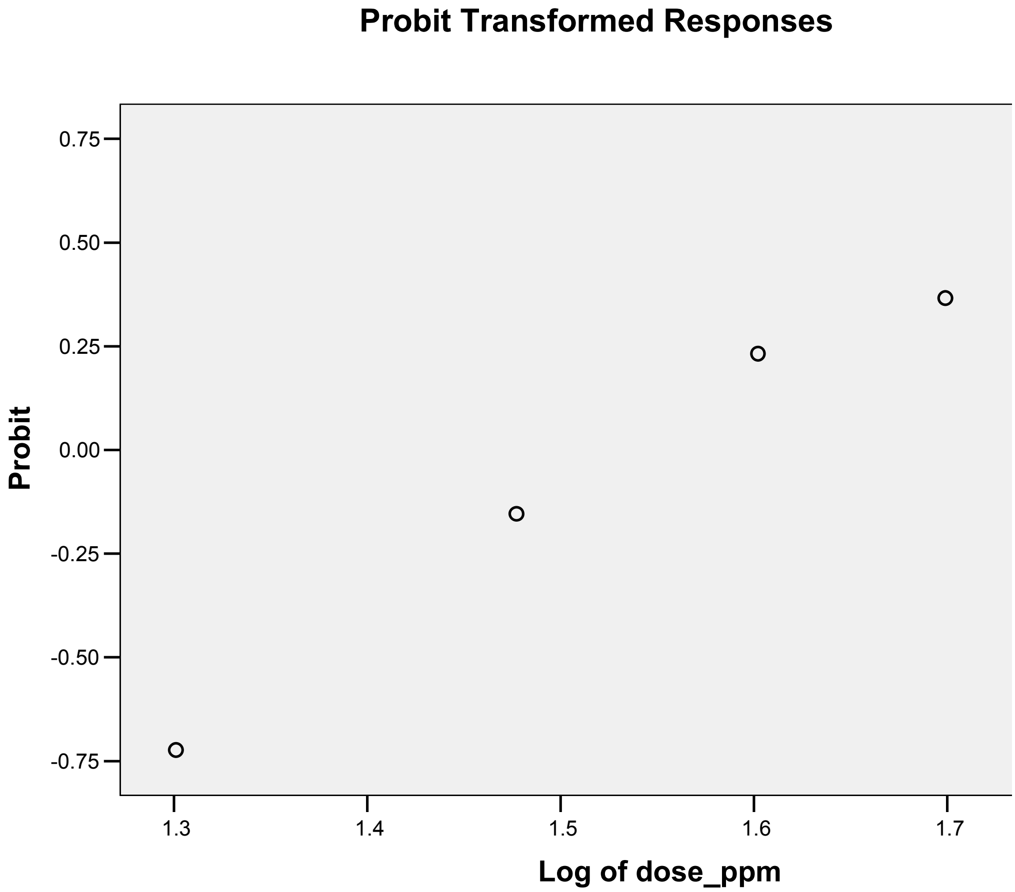
Since Goodness-of-Fit Chi square is NOT significant, no heterogeneity factor is used in the calculation of confidence limits.

Observed and Expected Frequencies

dose_ppm	Number of Subjects	Observed Responses	Expected Responses	Residual	Prob
1.78	60.0	45.0	44.983	.017	.74972
1.70	60.0	39.0	40.503	-1.503	.67505
1.60	60.0	36.0	34.424	1.576	.57373
1.48	60.0	27.0	26.245	.755	.43742
1.30	60.0	15.0	15.786	-.786	.26309

Confidence Limits for Effective dose_ppm

Prob	dose_ppm	95% Confidence Limits Lower	Upper
.01	5.17951	1.91491	8.58533
.02	6.47853	2.67241	10.17131
.03	7.46689	3.30109	11.32853
.04	8.30857	3.86921	12.28669
.05	9.06271	4.40226	13.12690
.06	9.75829	4.91301	13.88837
.07	10.41197	5.40896	14.59341
.08	11.03433	5.89495	15.25606
.09	11.63259	6.37434	15.88584
.10	12.21192	6.84958	16.48953
.15	14.93395	9.21733	19.25868
.20	17.52387	11.65441	21.81733
.25	20.10094	14.23023	24.32014
.30	22.73667	16.99100	26.86535
.35	25.48663	19.97077	29.54140
.40	28.40300	23.18978	32.45267
.45	31.54186	26.64552	35.74451
.50	34.96943	30.30306	39.62890
.55	38.76948	34.10688	44.39372
.60	43.05395	38.03459	50.38153
.65	47.98050	42.15327	57.98827
.70	53.78365	46.62587	67.75773
.75	60.83601	51.70617	80.58923
.80	69.78261	57.78910	98.14300
.85	81.88465	65.58693	123.86489
.90	100.13667	76.70429	166.45826
.91	105.12370	79.63746	178.82752
.92	110.82329	82.94319	193.32756
.93	117.44764	86.72783	210.65319
.94	125.31513	91.14925	231.87012
.95	134.93333	96.45611	258.71972
.96	147.18078	103.07280	294.30360
.97	163.77124	111.81339	344.88354
.98	188.75586	124.56158	425.92524
.99	236.09601	147.60889	594.26308


Probit Transformed Responses
Probit
0.75
0.50
0.25
0.00
-0.25
-0.50
-0.75
1.3
1.4
1.5
1.6
1.7
Log of dose_ppm

```
* * * * * * * * * * * * *  P R O B I T   A N A L Y S I S  * * * * * * *
* *

DATA  Information

          5 unweighted cases accepted.
          0 cases rejected because of missing data.
          0 cases are in the control group.
          0 cases rejected because LOG-transform can't be done.
MODEL Information

      ONLY Normal Sigmoid is requested.


 Parameter estimates converged after 13 iterations.
 Optimal solution found.

 Parameter Estimates (PROBIT model:  (PROBIT(p)) = Intercept + BX):

           Regression Coeff.  Standard Error     Coeff./S.E.

   dose_ppm          3.89500          .51062         7.62797


                   Intercept  Standard Error  Intercept/S.E.

                    -5.98140          .80783        -7.40426

  Pearson  Goodness-of-Fit  Chi Square =      1.280    DF = 3   P =
.734

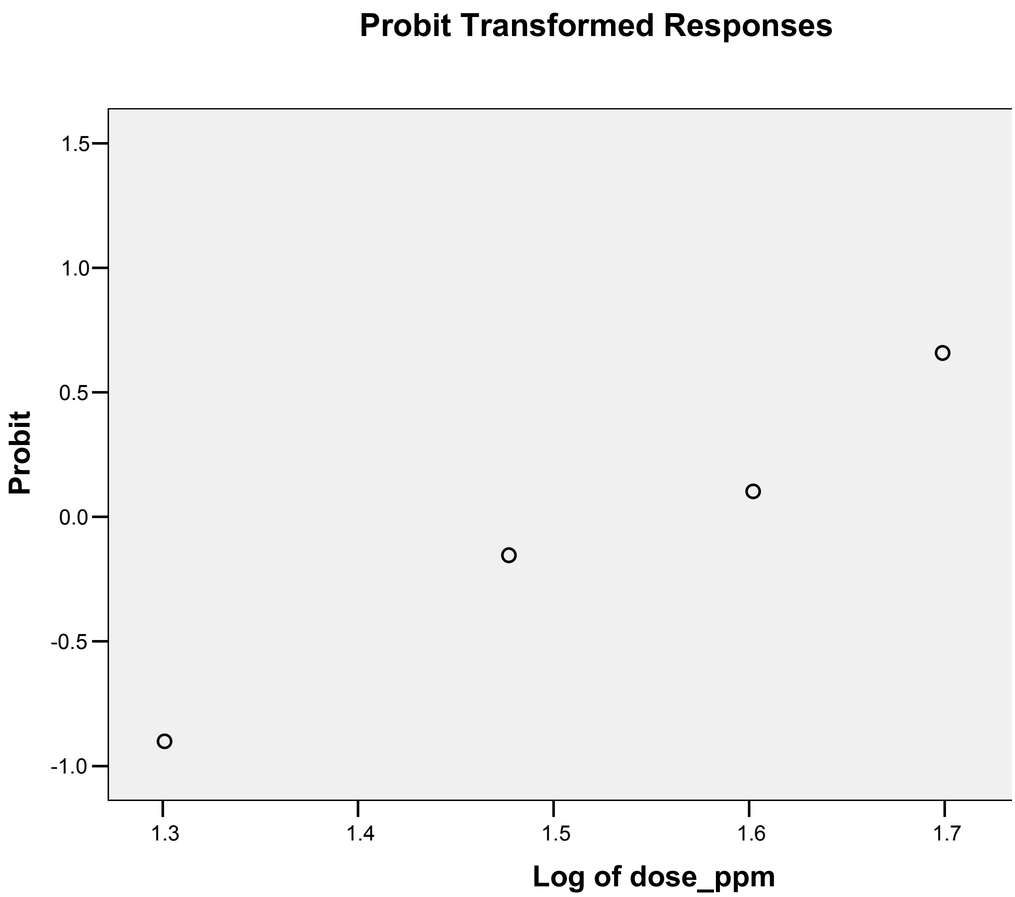
  Since Goodness-of-Fit Chi square is NOT significant, no
heterogeneity
  factor is used in the calculation of confidence limits.
```

Observed and Expected Frequencies

dose_ppm	Number of Subjects	Observed Responses	Expected Responses	Residual	Prob
1.78	60.0	51.0	49.860	1.140	.83099
1.70	60.0	45.0	44.573	.427	.74289
1.60	60.0	33.0	36.600	-3.600	.61000
1.48	60.0	27.0	25.297	1.703	.42162
1.30	60.0	12.0	11.807	.193	.19678

Confidence Limits for Effective dose_ppm

Prob	dose_ppm	95% Confidence Limits Lower	Upper
.01	8.67752	5.17138	11.83825
.02	10.19489	6.41516	13.47581
.03	11.29242	7.35389	14.63295
.04	12.19525	8.14860	15.57028
.05	12.98261	8.85717	16.37828
.06	13.69270	9.50791	17.10024
.07	14.34720	10.11705	17.76053
.08	14.95972	10.69489	18.37441
.09	15.53947	11.24842	18.95212
.10	16.09296	11.78264	19.50093
.15	18.60233	14.26902	21.96160
.20	20.87293	16.59714	24.16174
.25	23.04054	18.87396	26.25327
.30	25.17830	21.15620	28.32201
.35	27.33592	23.47940	30.43250
.40	29.55401	25.86737	32.64587
.45	31.87120	28.33569	35.03042
.50	34.32895	30.89411	37.66943
.55	36.97624	33.55149	40.66666
.60	39.87537	36.32601	44.15006
.65	43.11093	39.25954	48.27914
.70	46.80527	42.43214	53.26878
.75	51.14798	45.97879	59.44640
.80	56.45959	50.12512	67.37715
.85	63.35103	55.28575	78.17321
.90	73.22934	62.38424	94.48359
.91	75.83767	64.21295	98.93668
.92	78.77665	66.25404	104.02250
.93	82.13987	68.56634	109.92806
.94	86.06606	71.23655	116.93362
.95	90.77348	74.40004	125.48533
.96	96.63408	78.28565	136.35409
.97	104.35999	83.32720	151.04055
.98	115.59484	90.51358	173.08257
.99	135.80798	103.07580	214.62425


Probit Transformed Responses
1.5
1.0
0.5
0.0
-0.5
-1.0
Probit
1.3
1.4
1.5
1.6
1.7
Log of dose_ppm

Appendix (2):

```
* * * * * * * * * * * *  P R O B I T   A N A L Y S I S  * * * * * * *
* *

DATA  Information

          5 unweighted cases accepted.
          0 cases rejected because of missing data.
          0 cases are in the control group.
          0 cases rejected because LOG-transform can't be done.
MODEL Information

      ONLY Normal Sigmoid is requested.


 Parameter estimates converged after 12 iterations.
 Optimal solution found.

 Parameter Estimates (PROBIT model:  (PROBIT(p)) = Intercept + BX):

          Regression Coeff.  Standard Error     Coeff./S.E.

   dose_ppm          2.05467          .26429         7.77417


                  Intercept  Standard Error  Intercept/S.E.

                   -1.38679          .20694        -6.70130

  Pearson  Goodness-of-Fit  Chi Square =       .121    DF = 3   P =
.989

  Since Goodness-of-Fit Chi square is NOT significant, no
heterogeneity
  factor is used in the calculation of confidence limits.



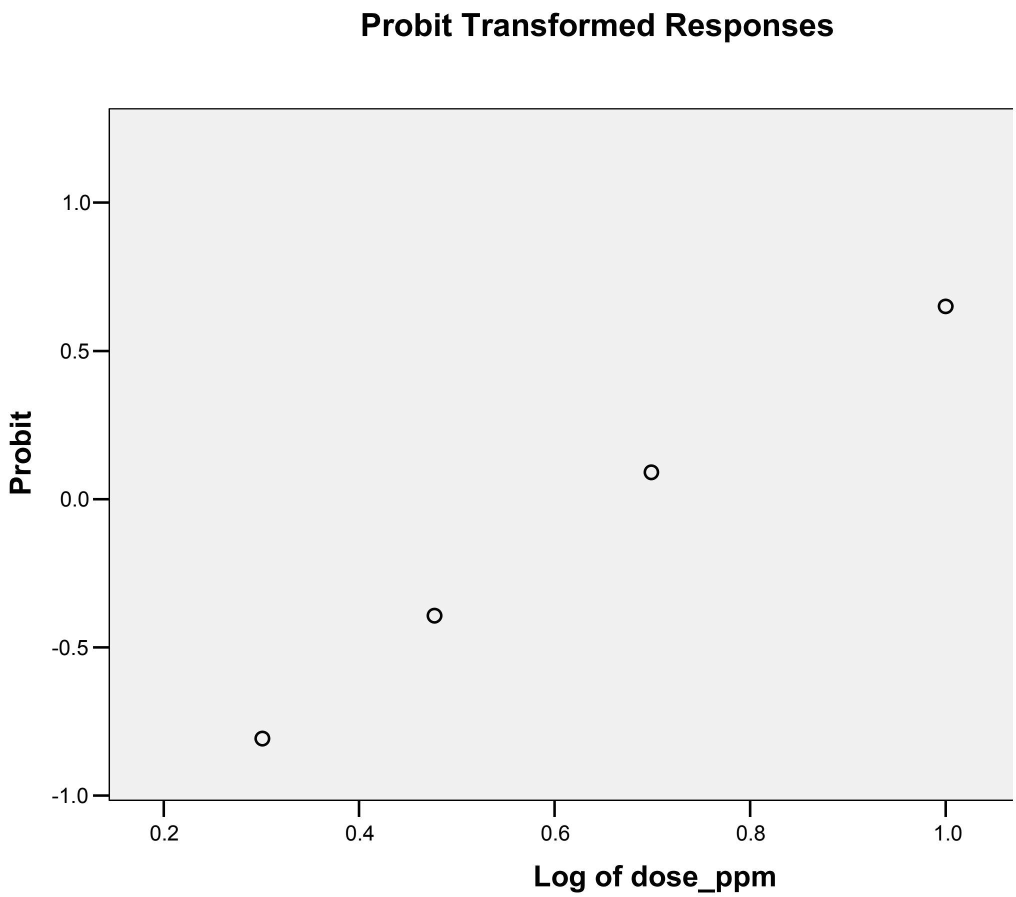

* * * * * * * * * * * *  P R O B I T   A N A L Y S I S  * * * * * * *
* *

 Observed and Expected Frequencies
```

dose_ppm	Number of Subjects	Observed Responses	Expected Responses	Residual	Prob
1.18	60.0	51.0	51.178	-.178	.85297
1.00	60.0	45.0	45.328	-.328	.75546
.70	60.0	33.0	32.046	.954	.53410
.48	60.0	22.0	21.716	.284	.36194
.30	60.0	14.0	14.672	-.672	.24453

Confidence Limits for Effective dose_ppm

Prob	dose_ppm	95% Confidence Limits Lower	Upper
.01	.34892	.13671	.61626
.02	.47358	.20511	.78875
.03	.57487	.26522	.92279
.04	.66511	.32171	1.03868
.05	.74886	.37635	1.14383
.06	.82840	.43005	1.24187
.07	.90507	.48333	1.33490
.08	.97972	.53655	1.42428
.09	1.05294	.58995	1.51092
.10	1.12517	.64373	1.59550
.15	1.48087	.92246	2.00189
.20	1.84217	1.22505	2.40290
.25	2.22163	1.55883	2.81720
.30	2.62857	1.92992	3.25903
.35	3.07192	2.34411	3.74299
.40	3.56156	2.80691	4.28696
.45	4.10946	3.32353	4.91477
.50	4.73089	3.89917	5.65915
.55	5.44631	4.54045	6.56515
.60	6.28414	5.25858	7.69483
.65	7.28580	6.07406	9.13629
.70	8.51465	7.02274	11.02328
.75	10.07429	8.16564	13.57811
.80	12.14945	9.61064	17.21092
.85	15.11370	11.56998	22.78893
.90	19.89155	14.55090	32.58049
.91	21.25606	15.37179	35.53553
.92	22.84469	16.31343	39.05679
.93	24.72886	17.41245	43.34033
.94	27.01746	18.72403	48.69138
.95	29.88726	20.33655	55.61717
.96	33.65071	22.40376	65.03906
.97	38.93292	25.22744	78.86127
.98	47.25999	29.52680	101.92980
.99	64.14552	37.80970	152.85181


Probit Transformed Responses
Probit
1.0
0.5
0.0
-0.5
-1.0
0.2
0.4
0.6
0.8
1.0
Log of dose_ppm

```
* * * * * * * * * * * * *  P R O B I T   A N A L Y S I S  * * * * * * *
* *

DATA  Information

          5 unweighted cases accepted.
          0 cases rejected because of missing data.
          0 cases are in the control group.
          0 cases rejected because LOG-transform can't be done.
MODEL Information

      ONLY Normal Sigmoid is requested.


 Parameter estimates converged after 12 iterations.
 Optimal solution found.

 Parameter Estimates (PROBIT model:  (PROBIT(p)) = Intercept + BX):

           Regression Coeff.  Standard Error     Coeff./S.E.

   Dose_ppm          3.77682          .52261         7.22683


                   Intercept  Standard Error  Intercept/S.E.

                    -4.77608          .67570        -7.06832

  Pearson  Goodness-of-Fit  Chi Square =      1.722    DF = 3   P =
.632

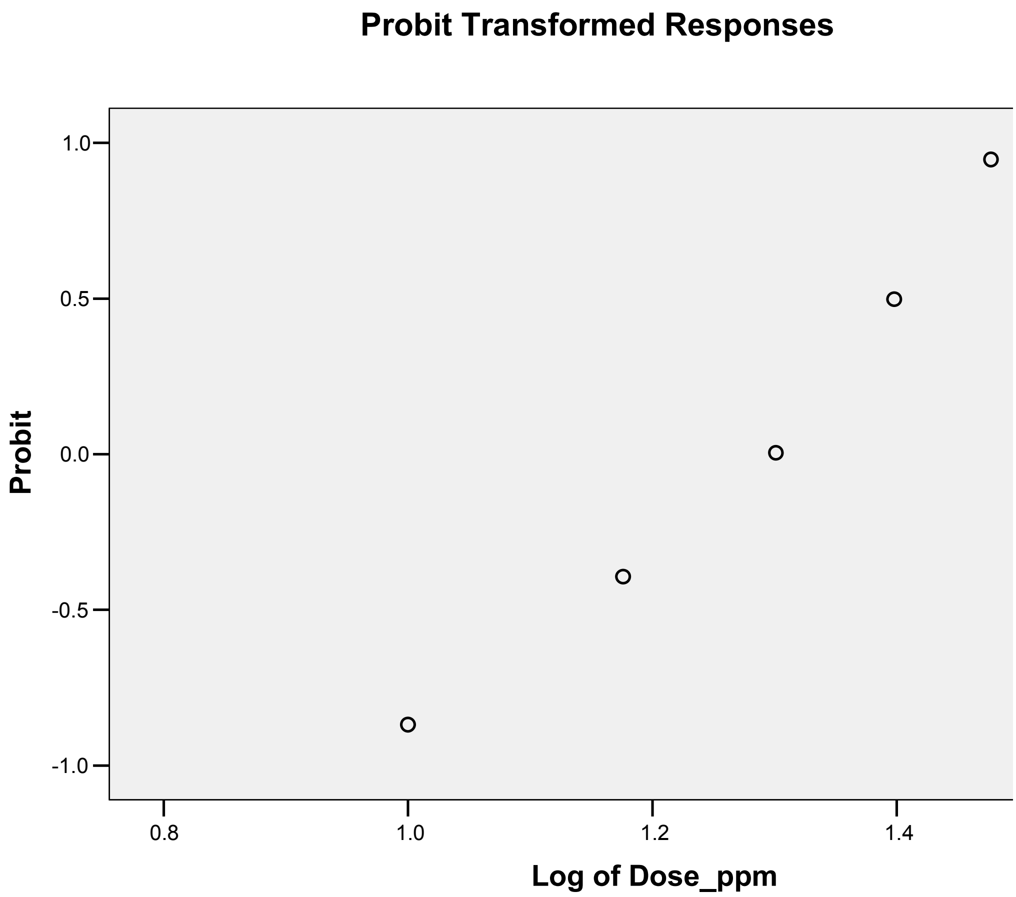
  Since Goodness-of-Fit Chi square is NOT significant, no
heterogeneity
  factor is used in the calculation of confidence limits.
```

Observed and Expected Frequencies

Dose_ppm	Number of Subjects	Observed Responses	Expected Responses	Residual	Prob
1.48	60.0	50.0	47.716	2.284	.79527
1.40	60.0	42.0	42.119	-.119	.70198
1.30	60.0	31.0	34.087	-3.087	.56811
1.18	60.0	22.0	23.283	-1.283	.38804
1.00	60.0	13.0	11.044	1.956	.18407

Confidence Limits for Effective Dose_ppm

		95% Confidence Limits	
Prob	Dose_ppm	Lower	Upper
.01	4.45269	2.55428	6.15367
.02	5.25775	3.20392	7.02322
.03	5.84243	3.69859	7.63909
.04	6.32474	4.11989	8.13878
.05	6.74628	4.49730	8.57011
.06	7.12713	4.84524	8.95596
.07	7.47872	5.17201	9.30922
.08	7.80822	5.48289	9.63797
.09	8.12047	5.78147	9.94763
.10	8.41893	6.07030	10.24207
.15	9.77591	7.42231	11.56554
.20	11.00876	8.69776	12.75412
.25	12.18962	9.95160	13.88978
.30	13.35765	11.21246	15.02024
.35	14.53967	12.49720	16.18311
.40	15.75787	13.81542	17.41588
.45	17.03356	15.17120	18.76175
.50	18.38980	16.56527	20.27317
.55	19.85404	18.00001	22.01274
.60	21.46133	19.48728	24.05357
.65	23.25946	21.05551	26.48499
.70	25.31770	22.75426	29.43063
.75	27.74367	24.66107	33.08566
.80	30.71962	26.90107	37.79314
.85	34.59369	29.70211	44.23314
.90	40.16960	33.57203	54.03369
.91	41.64597	34.57147	56.72370
.92	43.31141	35.68799	59.80301
.93	45.21962	36.95405	63.38778
.94	47.45035	38.41753	67.65249
.95	50.12913	40.15321	72.87554
.96	53.47019	42.28760	79.53931
.97	57.88429	45.06071	88.58598
.98	64.32128	49.02016	102.24635
.99	75.95066	55.95777	128.22627


Probit Transformed Responses
1.0
0.5
0.0
-0.5
-1.0
Probit
0.8
1.0
1.2
1.4
Log of Dose_ppm

```
* * * * * * * * * * * *  P R O B I T   A N A L Y S I S  * * * * * * * *
* *

DATA  Information

          5 unweighted cases accepted.
          0 cases rejected because of missing data.
          0 cases are in the control group.
          0 cases rejected because LOG-transform can't be done.
MODEL Information

      ONLY Normal Sigmoid is requested.


 Parameter estimates converged after 9 iterations.
 Optimal solution found.

 Parameter Estimates (PROBIT model:  (PROBIT(p)) = Intercept + BX):

           Regression Coeff.  Standard Error     Coeff./S.E.

   dose_ppm          2.17304           .27097         8.01943


                   Intercept  Standard Error  Intercept/S.E.

                    -1.73137           .22306        -7.76199

  Pearson  Goodness-of-Fit  Chi Square =      1.541    DF = 3   P =
.673

  Since Goodness-of-Fit Chi square is NOT significant, no
heterogeneity
  factor is used in the calculation of confidence limits.

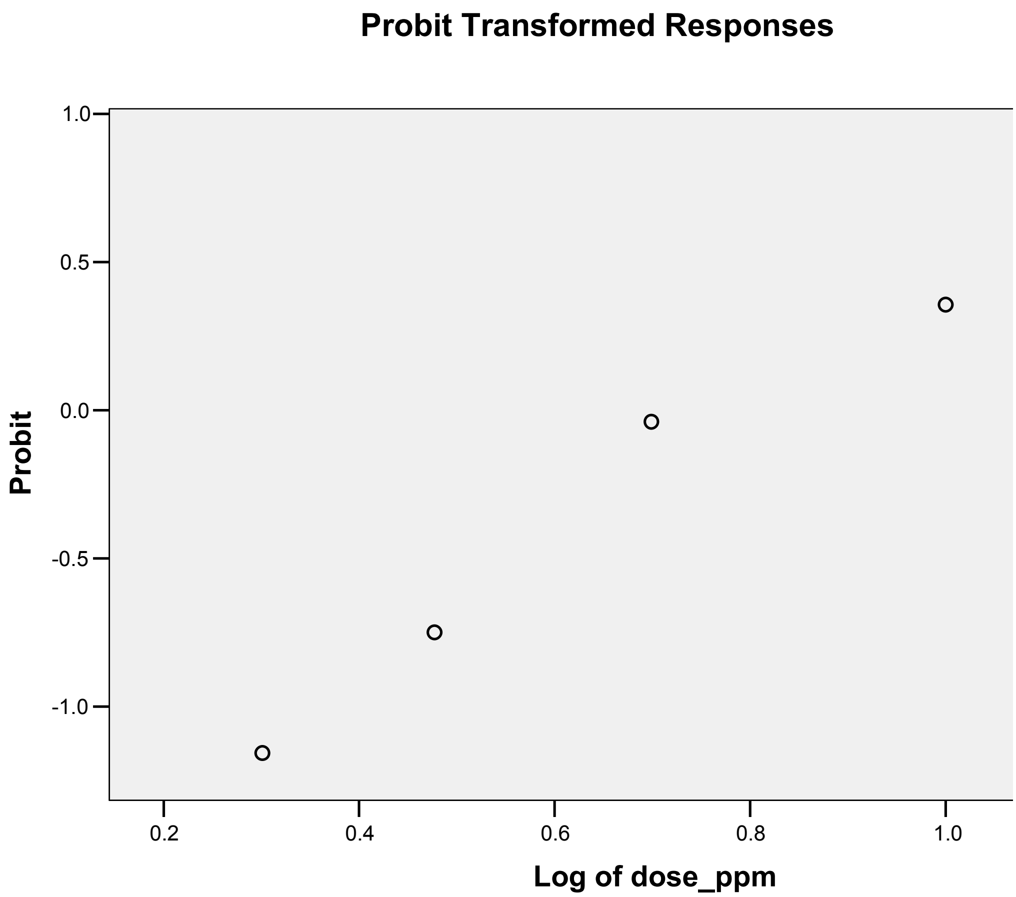


 Observed and Expected Frequencies
```

dose_ppm	Number of Subjects	Observed Responses	Expected Responses	Residual	Prob
1.18	60.0	48.0	48.076	-.076	.80127
1.00	60.0	39.0	40.831	-1.831	.68052
.70	60.0	30.0	26.003	3.997	.43339
.48	60.0	15.0	15.981	-.981	.26635
.30	60.0	9.0	9.988	-.988	.16647

Confidence Limits for Effective dose_ppm

Prob	dose_ppm	95% Confidence Limits Lower	Upper
.01	.53235	.23965	.87272
.02	.71063	.35010	1.10431
.03	.85356	.44507	1.28275
.04	.97974	.53298	1.43620
.05	1.09600	.61700	1.57483
.06	1.20577	.69873	1.70367
.07	1.31103	.77911	1.82561
.08	1.41304	.85876	1.94250
.09	1.51270	.93810	2.05559
.10	1.61064	1.01745	2.16582
.15	2.08832	1.42137	2.69377
.20	2.56713	1.84829	3.21357
.25	3.06449	2.30760	3.75140
.30	3.59275	2.80553	4.32765
.35	4.16323	3.34668	4.96352
.40	4.78809	3.93462	5.68437
.45	5.48178	4.57282	6.52206
.50	6.26252	5.26655	7.51701
.55	7.15445	6.02564	8.72109
.60	8.19097	6.86751	10.20372
.65	9.42036	7.82048	12.06439
.70	10.91617	8.92893	14.45694
.75	12.79791	10.26415	17.63869
.80	15.27744	11.94933	22.08213
.85	18.78020	14.22492	28.77563
.90	24.35005	17.66248	40.26749
.91	25.92654	18.60399	43.68689
.92	27.75505	19.68138	47.73723
.93	29.91480	20.93547	52.63241
.94	32.52615	22.42757	58.70363
.95	35.78378	24.25564	66.49798
.96	40.03029	26.58958	77.00217
.97	45.94754	29.76167	92.23837
.98	55.18915	34.56013	117.29766
.99	73.67154	43.71485	171.42208


Probit Transformed Responses
Probit
1.0
0.5
0.0
-0.5
-1.0
0.2
0.4
0.6
0.8
1.0
Log of dose_ppm

Appendix 3

```
* * * * * * * * * * * *  P R O B I T   A N A L Y S I S  * * * * * * *
* *

DATA  Information

          5 unweighted cases accepted.
          0 cases rejected because of missing data.
          0 cases are in the control group.
          0 cases rejected because LOG-transform can't be done.
MODEL Information

      ONLY Normal Sigmoid is requested.


 Parameter estimates converged after 9 iterations.
 Optimal solution found.

 Parameter Estimates (PROBIT model:  (PROBIT(p)) = Intercept + BX):

          Regression Coeff.  Standard Error     Coeff./S.E.

   Dose_ppm          1.36902          .17997         7.60702


                    Intercept  Standard Error  Intercept/S.E.

                       .51934          .09830         5.28299

  Pearson  Goodness-of-Fit  Chi Square =      1.231    DF = 3   P =
.746

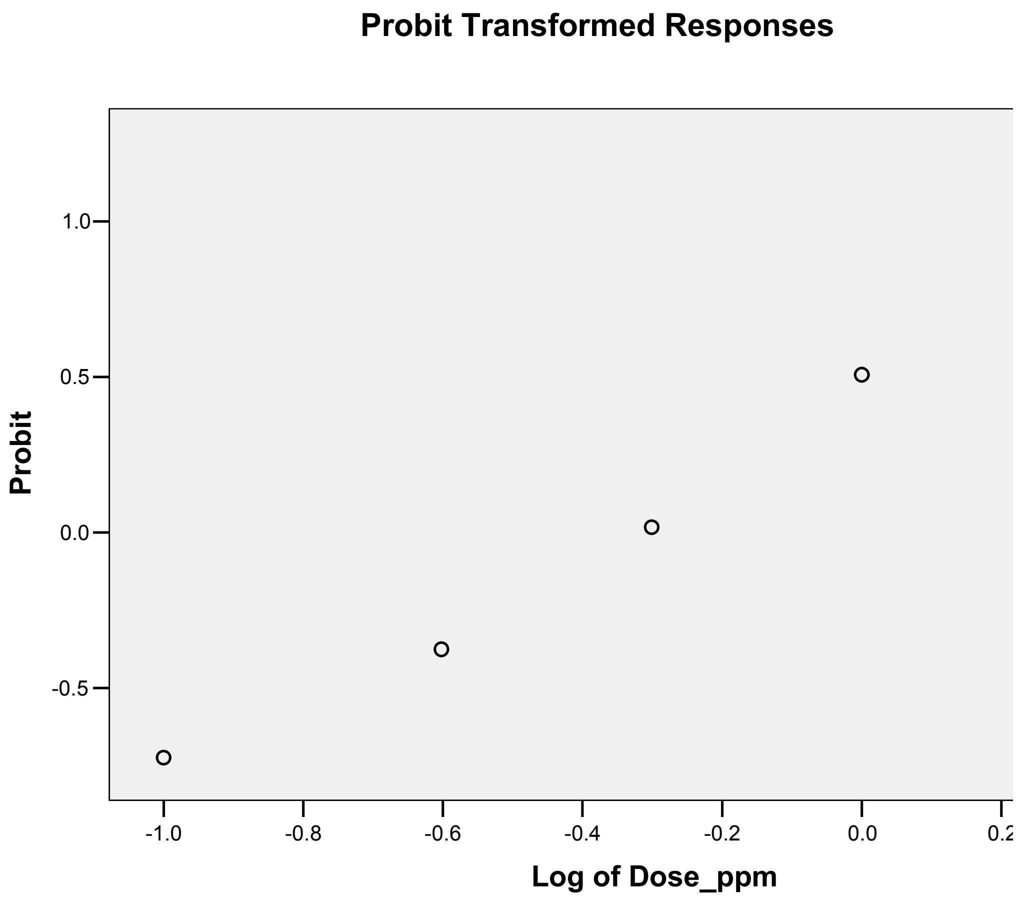
  Since Goodness-of-Fit Chi square is NOT significant, no
heterogeneity
  factor is used in the calculation of confidence limits.
```

Observed and Expected Frequencies

Dose_ppm	Number of Subjects	Observed Responses	Expected Responses	Residual	Prob
.40	60.0	53.0	51.554	1.446	.85924
.00	60.0	42.0	42.256	-.256	.70427
-.30	60.0	31.0	33.110	-2.110	.55184
-.60	60.0	22.0	23.557	-1.557	.39262
-1.00	60.0	15.0	12.828	2.172	.21380

Confidence Limits for Effective Dose_ppm

Prob	Dose_ppm	95% Confidence Limits Lower	Upper
.01	.00834	.00198	.01979
.02	.01320	.00365	.02862
.03	.01765	.00538	.03618
.04	.02197	.00721	.04317
.05	.02625	.00914	.04985
.06	.03055	.01118	.05637
.07	.03489	.01334	.06279
.08	.03929	.01563	.06917
.09	.04378	.01804	.07555
.10	.04837	.02058	.08195
.15	.07304	.03548	.11499
.20	.10136	.05450	.15103
.25	.13427	.07848	.19153
.30	.17282	.10842	.23809
.35	.21837	.14550	.29284
.40	.27264	.19105	.35881
.45	.33796	.24654	.44046
.50	.41749	.31359	.54459
.55	.51575	.39413	.68144
.60	.63930	.49099	.86654
.65	.79819	.60890	1.12417
.70	1.00855	.75597	1.49453
.75	1.29817	.94640	2.05016
.80	1.71954	1.20650	2.93671
.85	2.38623	1.59095	4.49335
.90	3.60378	2.23951	7.72023
.91	3.98111	2.43060	8.80460
.92	4.43592	2.65609	10.15833
.93	4.99621	2.92750	11.89128
.94	5.70603	3.26264	14.18232
.95	6.63946	3.69080	17.34406
.96	7.93302	4.26464	21.97829
.97	9.87360	5.09152	29.41841
.98	13.20720	6.44008	43.37228
.99	20.88964	9.31654	80.05847


Probit Transformed Responses
Probit
1.0
0.5
0.0
-0.5
-1.0
-0.8
-0.6
-0.4
-0.2
0.0
0.2
Log of Dose_ppm

```
* * * * * * * * * * * *  P R O B I T   A N A L Y S I S  * * * * * * *
* *

DATA  Information

          5 unweighted cases accepted.
          0 cases rejected because of missing data.
          0 cases are in the control group.
          0 cases rejected because LOG-transform can't be done.
MODEL Information

      ONLY Normal Sigmoid is requested.


 Parameter estimates converged after 12 iterations.
 Optimal solution found.

 Parameter Estimates (PROBIT model:  (PROBIT(p)) = Intercept + BX):

          Regression Coeff.  Standard Error     Coeff./S.E.

   Dose_ppm          2.35680          .27958         8.42967


                  Intercept  Standard Error  Intercept/S.E.

                    -.77392          .13681       -5.65702

  Pearson  Goodness-of-Fit  Chi Square =      3.293    DF = 3   P =
.349

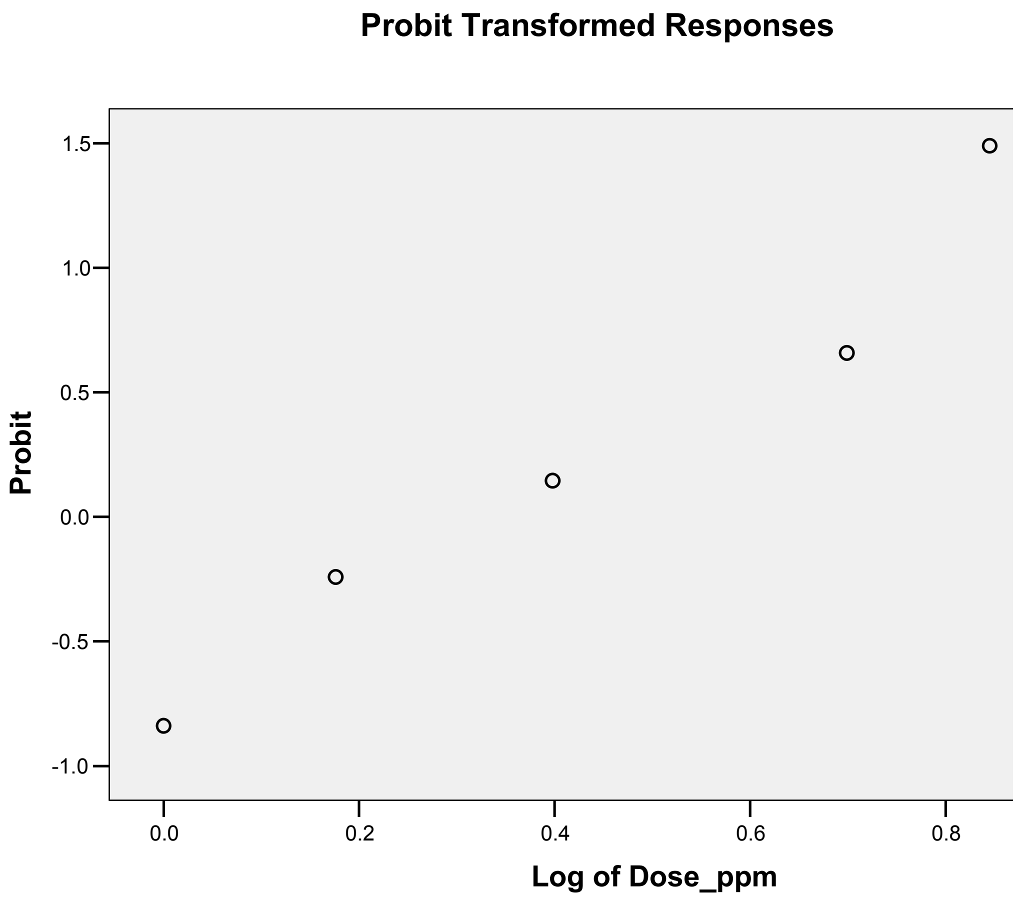
  Since Goodness-of-Fit Chi square is NOT significant, no
heterogeneity
  factor is used in the calculation of confidence limits.


 Observed and Expected Frequencies
```

Dose_ppm	Number of Subjects	Observed Responses	Expected Responses	Residual	Prob
.85	60.0	56.0	53.435	2.565	.89058
.70	60.0	45.0	48.756	-3.756	.81261
.40	60.0	34.0	34.429	-.429	.57381
.18	60.0	25.0	22.358	2.642	.37264
.00	60.0	13.0	14.106	-1.106	.23510

Confidence Limits for Effective Dose_ppm

Prob	Dose_ppm	95% Confidence Limits Lower	Upper
.01	.21943	.10321	.35383
.02	.28639	.14566	.44030
.03	.33912	.18118	.50599
.04	.38508	.21345	.56191
.05	.42703	.24386	.61202
.06	.46631	.27310	.65827
.07	.50372	.30157	.70177
.08	.53976	.32953	.74323
.09	.57476	.35718	.78313
.10	.60899	.38464	.82183
.15	.77377	.52206	1.00465
.20	.93599	.66431	1.18067
.25	1.10202	.81532	1.35864
.30	1.27606	.97787	1.54454
.35	1.46179	1.15436	1.74384
.40	1.66296	1.34707	1.96270
.45	1.88390	1.55824	2.20880
.50	2.12999	1.79030	2.49228
.55	2.40822	2.04622	2.82685
.60	2.72818	2.33040	3.23127
.65	3.10363	2.65011	3.73194
.70	3.55535	3.01764	4.36819
.75	4.11686	3.45386	5.20367
.80	4.84709	3.99576	6.35258
.85	5.86328	4.71564	8.04965
.90	7.44981	5.78421	10.88858
.91	7.89343	6.07374	11.71847
.92	8.40535	6.40364	12.69402
.93	9.00663	6.78589	13.86315
.94	9.72915	7.23844	15.29960
.95	10.62420	7.78982	17.12415
.96	11.78152	8.48937	19.55259
.97	13.37848	9.43307	23.02222
.98	15.84136	10.84718	28.61827
.99	20.67557	13.50812	40.35674


Probit Transformed Responses
Probit
1.5
1.0
0.5
0.0
-0.5
-1.0
0.0
0.2
0.4
0.6
0.8
Log of Dose_ppm

```
* * * * * * * * * * * * *  P R O B I T   A N A L Y S I S  * * * * * * *
* *

DATA  Information

          5 unweighted cases accepted.
          0 cases rejected because of missing data.
          0 cases are in the control group.
          0 cases rejected because LOG-transform can't be done.
MODEL Information

      ONLY Normal Sigmoid is requested.


 Parameter estimates converged after 11 iterations.
 Optimal solution found.

 Parameter Estimates (PROBIT model:  (PROBIT(p)) = Intercept + BX):

          Regression Coeff.  Standard Error     Coeff./S.E.

   Dose_ppm          1.90675          .23993         7.94708


                  Intercept  Standard Error  Intercept/S.E.

                   -.26006          .09286       -2.80052

  Pearson  Goodness-of-Fit  Chi Square =      1.208    DF = 3   P =
.751

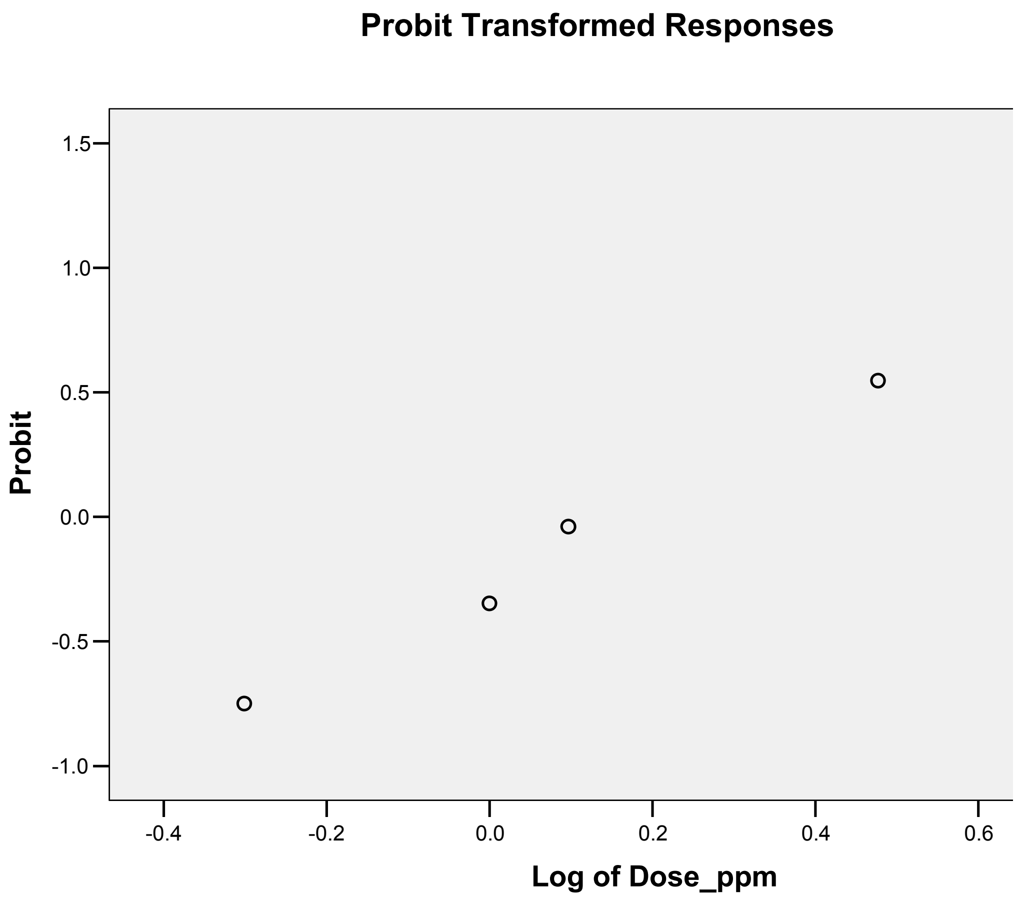
  Since Goodness-of-Fit Chi square is NOT significant, no
heterogeneity
  factor is used in the calculation of confidence limits.
```

Observed and Expected Frequencies

Dose_ppm	Number of Subjects	Observed Responses	Expected Responses	Residual	Prob
.78	60.0	55.0	53.567	1.433	.89278
.48	60.0	43.0	44.987	-1.987	.74979
.10	60.0	30.0	29.154	.846	.48590
.00	60.0	23.0	24.929	-1.929	.41549
-.30	60.0	15.0	13.564	1.436	.22606

Confidence Limits for Effective Dose_ppm

Prob	Dose_ppm	95% Confidence Limits Lower	Upper
.01	.08248	.03099	.15055
.02	.11463	.04782	.19667
.03	.14125	.06294	.23311
.04	.16529	.07738	.26498
.05	.18782	.09151	.29416
.06	.20940	.10553	.32157
.07	.23036	.11956	.34774
.08	.25090	.13368	.37304
.09	.27116	.14795	.39769
.10	.29126	.16240	.42187
.15	.39159	.23853	.53951
.20	.49545	.32294	.65763
.25	.60625	.41767	.78150
.30	.72672	.52456	.91536
.35	.85962	.64545	1.06380
.40	1.00814	.78218	1.23256
.45	1.17622	.93663	1.42940
.50	1.36896	1.11080	1.66504
.55	1.59329	1.30735	1.95441
.60	1.85891	1.53045	2.31842
.65	2.18008	1.78735	2.78738
.70	2.57878	2.09037	3.40810
.75	3.09121	2.46045	4.25937
.80	3.78252	2.93490	5.48814
.85	4.78576	3.58795	7.40878
.90	6.43434	4.59905	10.85632
.91	6.91120	4.88069	11.91214
.92	7.46938	5.20530	13.17821
.93	8.13530	5.58612	14.72903
.94	8.94945	6.04321	16.68123
.95	9.97789	6.60879	19.22998
.96	11.33817	7.33925	22.73248
.97	13.26717	8.34596	27.93387
.98	16.34877	9.89647	36.75280
.99	22.72220	12.93465	56.68464


Probit Transformed Responses
1.5
1.0
0.5
0.0
-0.5
-1.0
Probit
-0.4
-0.2
0.0
0.2
0.4
0.6
Log of Dose_ppm

Appendix 4

DATA Information

5 unweighted cases accepted.
0 cases rejected because of missing data.
0 cases are in the control group.
0 cases rejected because LOG-transform can't be done.

MODEL Information

ONLY Normal Sigmoid is requested.

Parameter estimates converged after 11 iterations.
Optimal solution found.

Parameter Estimates (PROBIT model: (PROBIT(p)) = Intercept + BX):

	Regression Coeff.	Standard Error	Coeff./S.E.
dose_ppm	1.19280	.19861	6.00562

Intercept	Standard Error	Intercept/S.E.
.35551	.09575	3.71302

Pearson Goodness-of-Fit Chi Square = .984 DF = 3 P = .805

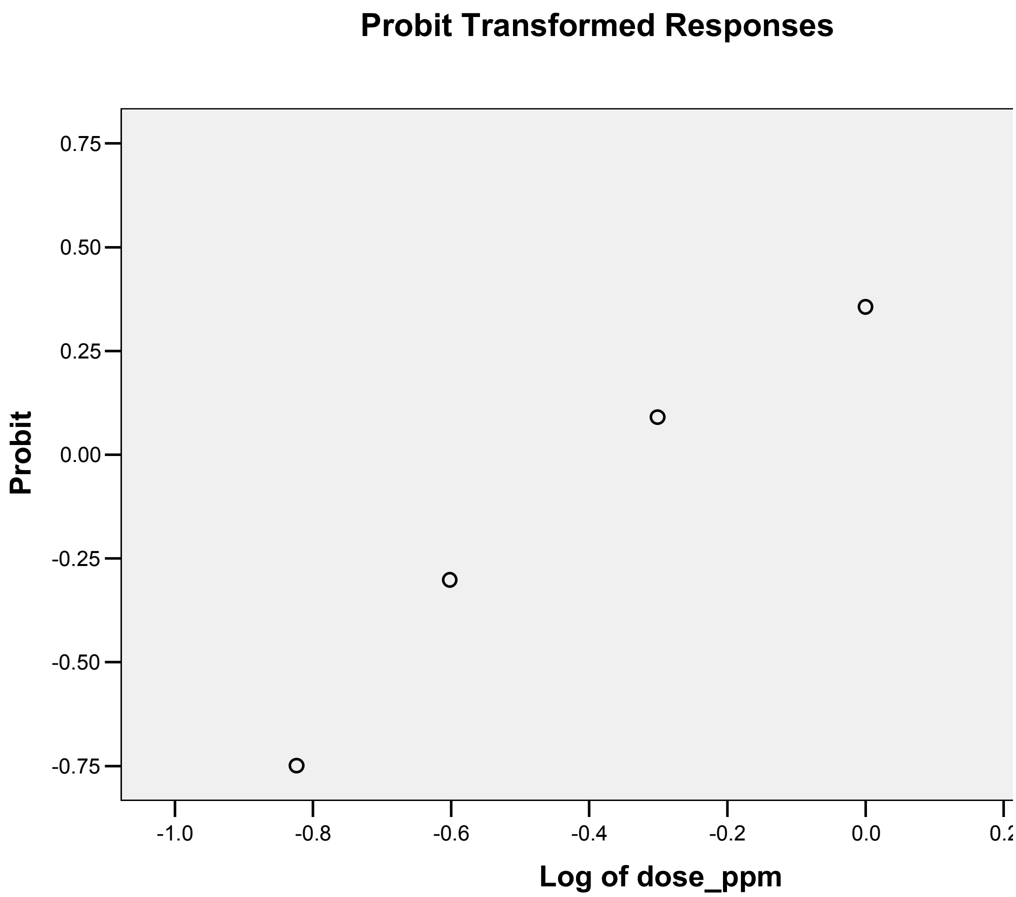
Since Goodness-of-Fit Chi square is NOT significant, no heterogeneity factor is used in the calculation of confidence limits.

Observed and Expected Frequencies

dose_ppm	Number of Subjects	Observed Responses	Expected Responses	Residual	Prob
.30	60.0	45.0	46.181	-1.181	.76969
.00	60.0	39.0	38.984	.016	.64973
-.30	60.0	33.0	30.817	2.183	.51362
-.60	60.0	24.0	22.661	1.339	.37769
-.82	60.0	15.0	17.237	-2.237	.28729

Confidence Limits for Effective dose_ppm

		95% Confidence Limits	
Prob	dose_ppm	Lower	Upper
.01	.00564	.00061	.01773
.02	.00955	.00133	.02646
.03	.01334	.00217	.03414
.04	.01715	.00315	.04136
.05	.02104	.00425	.04836
.06	.02503	.00549	.05526
.07	.02915	.00687	.06212
.08	.03342	.00839	.06901
.09	.03784	.01007	.07594
.10	.04242	.01191	.08295
.15	.06808	.02377	.11983
.20	.09917	.04101	.16114
.25	.13693	.06520	.20872
.30	.18294	.09827	.26487
.35	.23929	.14257	.33297
.40	.30872	.20065	.41848
.45	.39501	.27477	.53058
.50	.50345	.36648	.68469
.55	.64166	.47692	.90555
.60	.82102	.60885	1.23158
.65	1.05924	.76899	1.72471
.70	1.38545	.96992	2.49402
.75	1.85106	1.23355	3.75090
.80	2.55587	1.60018	5.95335
.85	3.72273	2.15419	10.26204
.90	5.97529	3.11442	20.47057
.91	6.69874	3.40236	24.20066
.92	7.58426	3.74467	29.03297
.93	8.69364	4.16003	35.47481
.94	10.12553	4.67754	44.38316
.95	12.04863	5.34541	57.31908
.96	14.77963	6.25102	77.43459
.97	18.99943	7.57445	112.12326
.98	26.53016	9.77225	183.49356
.99	44.90311	14.58785	399.19419


Probit Transformed Responses
Probit
0.75
0.50
0.25
0.00
-0.25
-0.50
-0.75
-1.0
-0.8
-0.6
-0.4
-0.2
0.0
Log of dose_ppm

```
* * * * * * * * * * * *  P R O B I T   A N A L Y S I S  * * * * * * *
* *

DATA  Information

          5 unweighted cases accepted.
          0 cases rejected because of missing data.
          0 cases are in the control group.
          0 cases rejected because LOG-transform can't be done.
MODEL Information

      ONLY Normal Sigmoid is requested.


 Parameter estimates converged after 12 iterations.
 Optimal solution found.

 Parameter Estimates (PROBIT model:  (PROBIT(p)) = Intercept + BX):

           Regression Coeff.  Standard Error     Coeff./S.E.

   Dose_ppm          3.93831           .52829         7.45482


                   Intercept  Standard Error  Intercept/S.E.

                    -4.93890           .68144        -7.24777

  Pearson  Goodness-of-Fit  Chi Square =      4.129    DF = 3   P =
.248

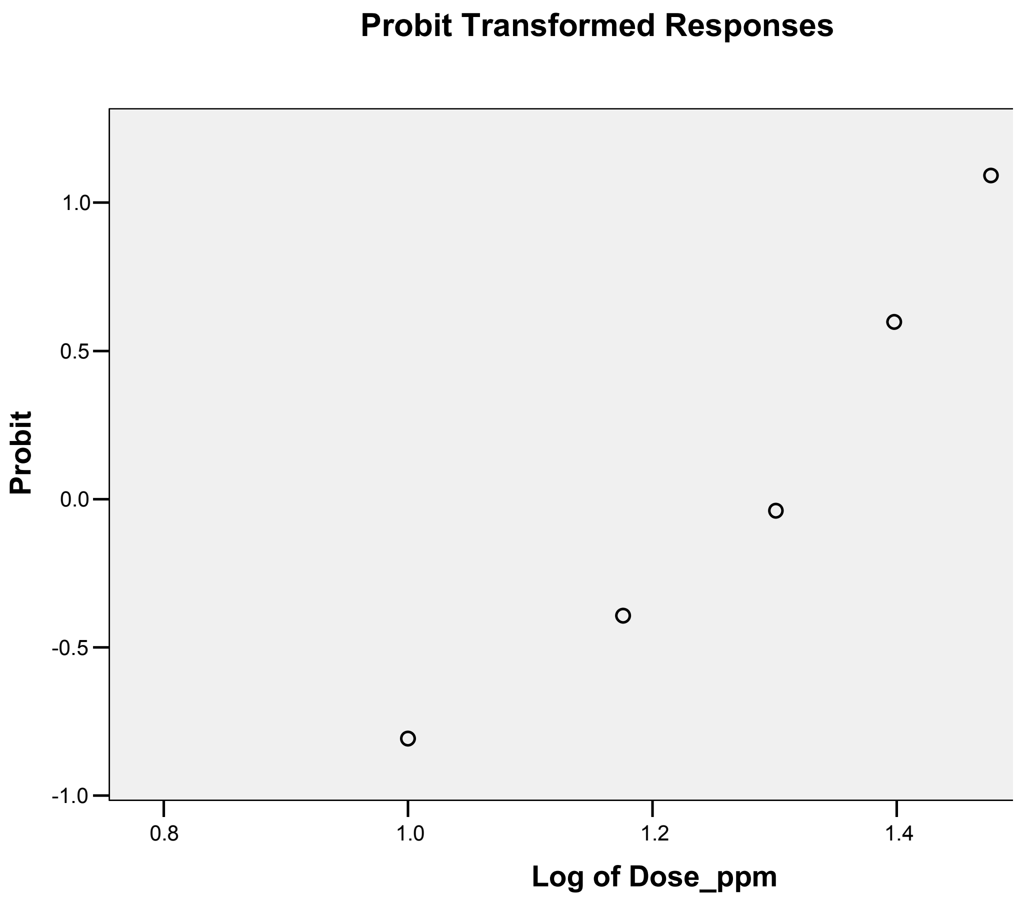
  Since Goodness-of-Fit Chi square is NOT significant, no
heterogeneity
  factor is used in the calculation of confidence limits.
```

 Observed and Expected Frequencies

Dose_ppm	Number of Subjects	Observed Responses	Expected Responses	Residual	Prob
1.48	60.0	52.0	48.951	3.049	.81585
1.40	60.0	44.0	43.385	.615	.72308
1.30	60.0	30.0	35.170	-5.170	.58617
1.18	60.0	22.0	23.880	-1.880	.39801
1.00	60.0	14.0	11.025	2.975	.18376

Confidence Limits for Effective Dose_ppm

Prob	Dose_ppm	95% Confidence Limits Lower	Upper
.01	4.60647	2.74285	6.26402
.02	5.40239	3.40018	7.11652
.03	5.97726	3.89598	7.71806
.04	6.44968	4.31551	8.20487
.05	6.86137	4.68943	8.62423
.06	7.23242	5.03271	8.99872
.07	7.57423	5.35394	9.34108
.08	7.89397	5.65858	9.65926
.09	8.19646	5.95032	9.95861
.10	8.48514	6.23180	10.24291
.15	9.79261	7.54081	11.51704
.20	10.97399	8.76471	12.65611
.25	12.10046	9.95953	13.73966
.30	13.21028	11.15449	14.81308
.35	14.32935	12.36719	15.91103
.40	15.47878	13.60857	17.06687
.45	16.67855	14.88482	18.31812
.50	17.95005	16.19916	19.70995
.55	19.31848	17.55543	21.29709
.60	20.81587	18.96423	23.14485
.65	22.48561	20.44983	25.33361
.70	24.39042	22.05580	27.97295
.75	26.62744	23.85229	31.23281
.80	29.36072	25.95407	35.40894
.85	32.90278	28.57070	41.08431
.90	37.97275	32.16828	49.64683
.91	39.31016	33.09453	51.98297
.92	40.81650	34.12804	54.65041
.93	42.53952	35.29846	57.74702
.94	44.54998	36.64946	61.41948
.95	46.95916	38.24922	65.90124
.96	49.95660	40.21295	71.59561
.97	53.90502	42.75890	79.28755
.98	59.64106	46.38425	90.82712
.99	69.94595	52.71164	112.56255


Probit Transformed Responses
1.0
0.5
0.0
-0.5
-1.0
Probit
0.8
1.0
1.2
1.4
Log of Dose_ppm

```
* * * * * * * * * * * * *  P R O B I T   A N A L Y S *************

DATA  Information

          5 unweighted cases accepted.
          0 cases rejected because of missing data.
          0 cases are in the control group.
          0 cases rejected because LOG-transform can't be done.
MODEL Information

      ONLY Normal Sigmoid is requested.


 Parameter estimates converged after 10 iterations.
 Optimal solution found.

 Parameter Estimates (PROBIT model:  (PROBIT(p)) = Intercept + BX):

          Regression Coeff.  Standard Error     Coeff./S.E.

   dose_ppm          2.85636          .50346         5.67345


                  Intercept  Standard Error  Intercept/S.E.

                    -.96734          .16700        -5.79232

  Pearson  Goodness-of-Fit  Chi Square =       .749    DF = 3   P =
.862

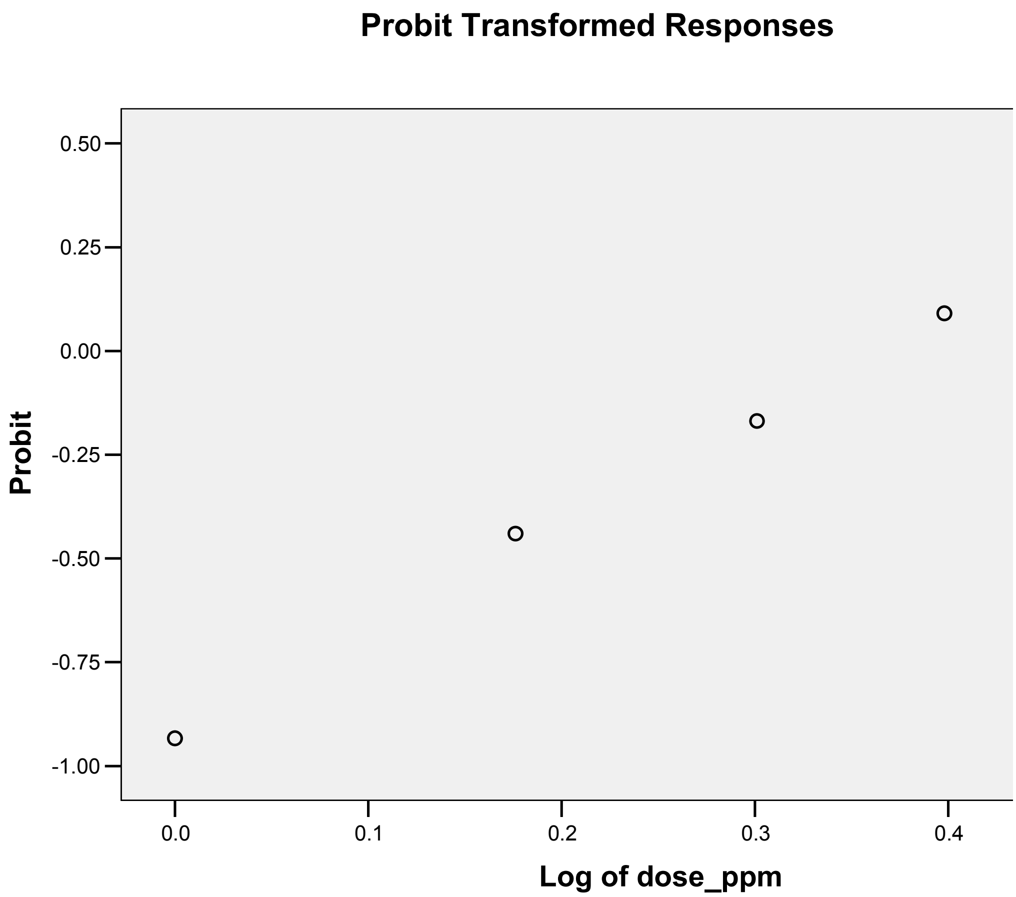
  Since Goodness-of-Fit Chi square is NOT significant, no
heterogeneity
  factor is used in the calculation of confidence limits.
```

Observed and Expected Frequencies

dose_ppm	Number of Subjects	Observed Responses	Expected Responses	Residual	Prob
.48	60.0	42.0	39.849	2.151	.66415
.40	60.0	33.0	34.813	-1.813	.58021
.30	60.0	27.0	28.409	-1.409	.47349
.18	60.0	21.0	20.494	.506	.34156
.00	60.0	12.0	11.501	.499	.1916

Confidence Limits for Effective dose_ppm

Prob	dose_ppm	95% Confidence Limits Lower	Upper
.01	.33436	.12981	.53324
.02	.41653	.18128	.62895
.03	.47885	.22401	.69858
.04	.53181	.26261	.75614
.05	.57917	.29883	.80656
.06	.62279	.33353	.85223
.07	.66373	.36721	.89449
.08	.70267	.40020	.93420
.09	.74006	.43272	.97195
.10	.77624	.46495	1.00814
.15	.94582	.62514	1.17445
.20	1.10666	.78910	1.32916
.25	1.26626	.96072	1.48250
.30	1.42913	1.14168	1.64202
.35	1.59868	1.33171	1.81591
.40	1.77814	1.52823	2.01486
.45	1.97091	1.72701	2.25248
.50	2.18103	1.92516	2.54331
.55	2.41354	2.12426	2.90115
.60	2.67520	2.32999	3.34153
.65	2.97550	2.55024	3.88729
.70	3.32852	2.79487	4.57560
.75	3.75662	3.07729	5.46983
.80	4.29842	3.41872	6.68593
.85	5.02935	3.85845	8.46263
.90	6.12812	4.48597	11.40122
.91	6.42767	4.65142	12.25446
.92	6.76972	4.83778	13.25472
.93	7.16687	5.05099	14.45001
.94	7.63802	5.29986	15.91396
.95	8.21330	5.59825	17.76690
.96	8.94477	5.96978	20.22325
.97	9.93389	6.45973	23.71598
.98	11.42011	7.17266	29.31497
.99	14.22676	8.45690	40.95415


Probit Transformed Responses
0.50
0.25
0.00
-0.25
-0.50
-0.75
-1.00
Probit
0.0
0.1
0.2
0.3
0.4
Log of dose_ppm

حساسية ثلاثة مجتمعات من منّ الدراق الأخضر لأربعة مبيدات حشريه ، وبعض السمات الحياتيه للمنّ لثلاثة أجيال

إعداد

باسل فايز يوسف خضر

المشرف

الأستاذ الدكتور توفيق مصطفى العنتري

ملخص

أجريت تجارب مخبريه لتقيم سمية أربعة من المبيدات التقليديه والحديثه شائعة الأستعمال على حشرة منّ الدراق الأخضر *Myzus persicae* ، والتي جمعت من منطقة مادبا، وديرعلا، ومن الوديان البعيده عن المزارع في منطقة أم العمد على عشبة الخردل البري وتم تربيتها داخل البيت الزجاجي في الجامعه الاردنيه لعشرة أجيال لاعتمادها كسلاله حساسه في التجربه ، وتم تربية السلالات الثلاثه على نبات الفلفل الحلو داخل البيت الزجاجي وفي المختبر أيضا .

كان التركيز القاتل ل50%و90% (ت ق50 و ت ق 90)لأعداد المنّ للمبيدات كليبسو، كراتي ايفسكت، والدايميثويت على التوالي هو (34.97 ، 100.14) ،(40.17 ، 18.34) (2.13 ، 7.45) ، (37.97 ، 17.95).

وكانت النسبه بين ت ق 50 للسلاله الحساسه مقسوما على ت ق50 لسلالتي الحقل (عامل المقاومه) لأعداد المنّ للمبيدات كليبسو، كراتي، ايفسكت والدايميتويث على التوالي:

(1.32 ، 3.88، 5.07، 35.9).

وبناءا على ذلك كان مبيد الكليبسو هو أكثرالمبيدات المستخدمه سمية ، ويليه مبيد الكراتي ثم الأيفسكت اللذان أبديا فعاليه جيده على المنّ . وكان مبيد الدايميثويت الأقل فعالية والأكثر مقاومه للمنّ له. ودلت النتائج أن جميع مجتمعات منّ الدراق الأخضر المستخدمه كانت مقاومه لمبيد الدايميثويت،لذا ينصح بعدم استعماله لمكافحة المنّ. لأن الديميثويت كان الأقل فعاليه مقارنة بالمبيدات الأخرى المستخدمه في هذه التجربه، وعلى الأرجح فأنه أصبح عند منّ الدراق الأخضر مقاومه للدايميثويت. وبخصوص التجارب التي اجريت على منّ الدراق الأخضر والمتعلقه بطول العمر والأعداد الناتجه بعد رش تركيز ت.ق 50 لكل مبيد على حدى. أظهرت

النتائج أن مبيد الكليبسو أظهر زياده معنويه على طول العمر والأعداد الناتجه عنه، بينما أظهر مبيد الكراتي العكس حيث قلل من طول العمر والأعداد الناتجه عنه، في حين أظهرت النتائج الخاصه بمبيد الأيفسكت زياده قليله على الأعداد الناتجه عن كل جيل فقط ولم يؤثر على العمر.

أما مبيد الدايميثويت أظهر زياده على طول والأعداد الناتجه عن كل جيل بشكل أعلى من مبيد الأيفسكت ولكن أقل من مبيد الكليبسو.